

THE SURVIVOR

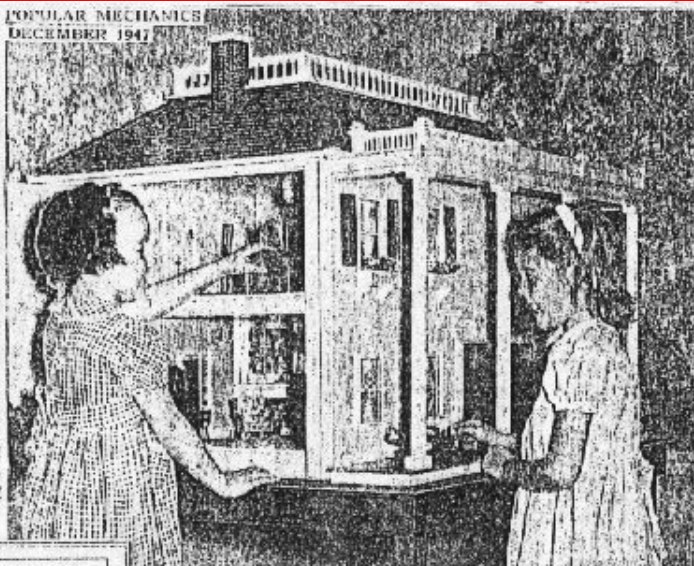
Volume 10

By Kurt Saxon

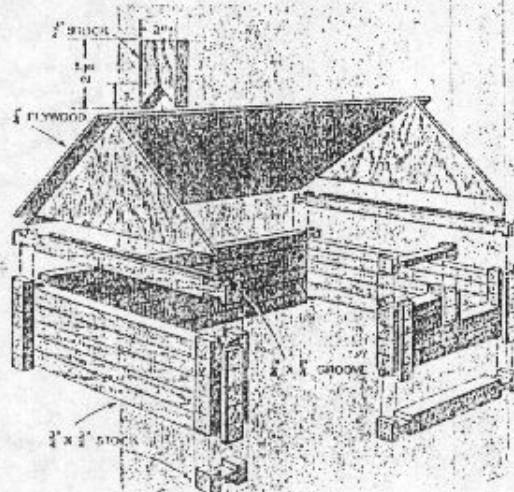
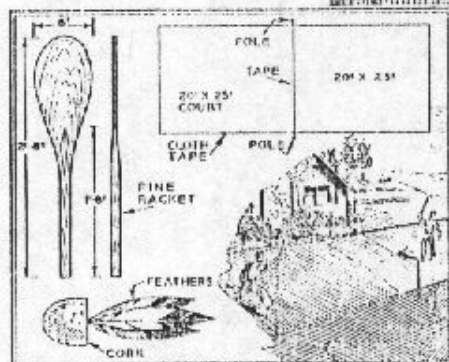
POPULAR MECHANICS
DECEMBER 1947



Benign-looking critter can be walked along, bounced on, but is shifty enough to buck if child puts weight far forward.

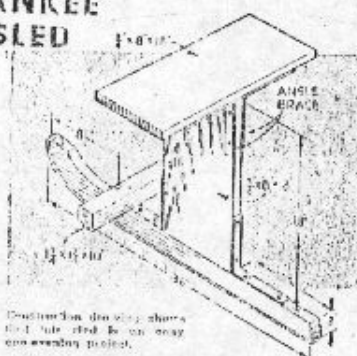


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Mexican Patio Furniture
for Children's Dolls

YANKEE
SLED



Construction also shows
that sled can be on away
and even be pulled.



Sand Toy

THE SURVIVOR

Volume 10

By Kurt Saxon

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ISBN 1-881801-16-0

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Web site SURVIVALPLUS.COM

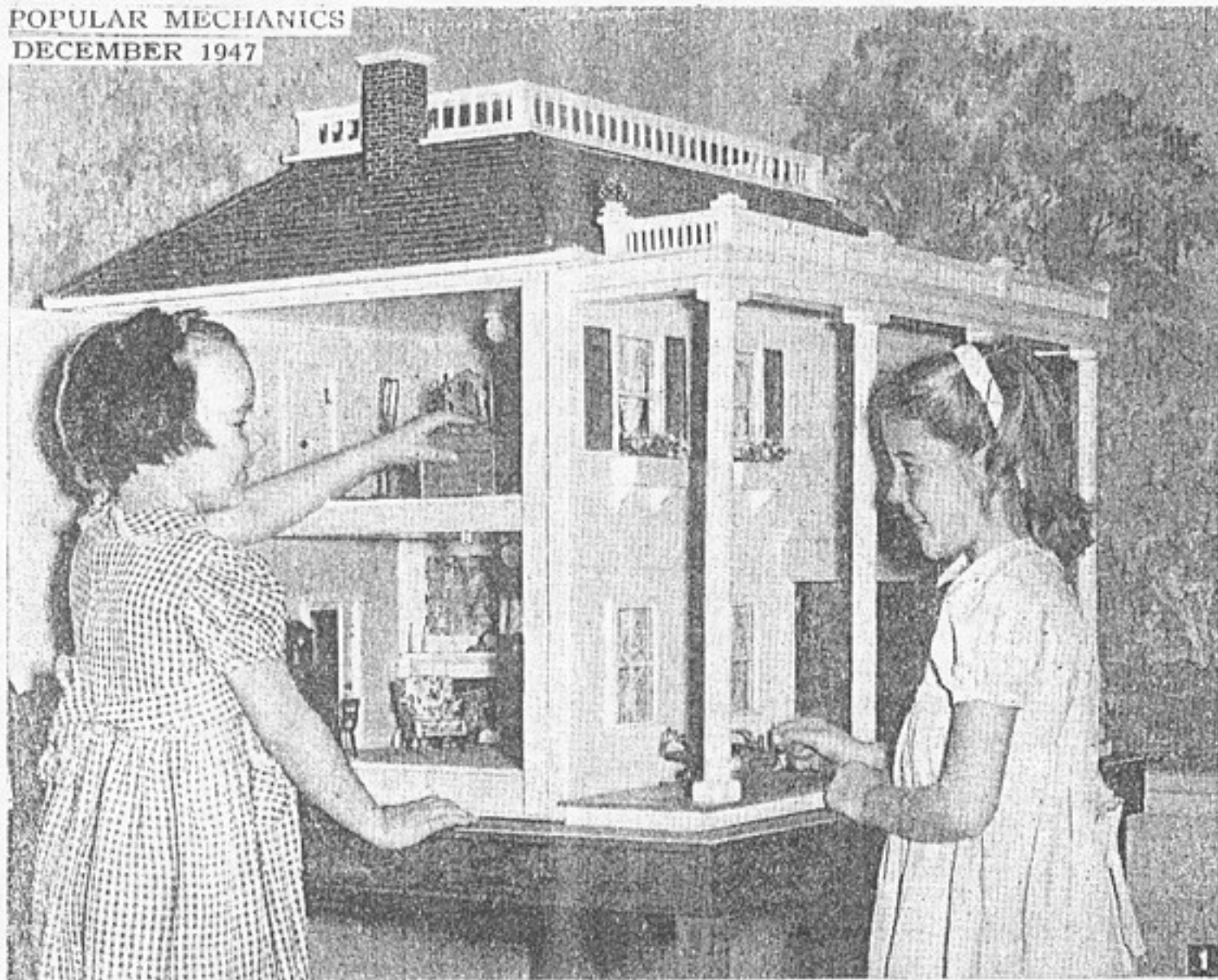
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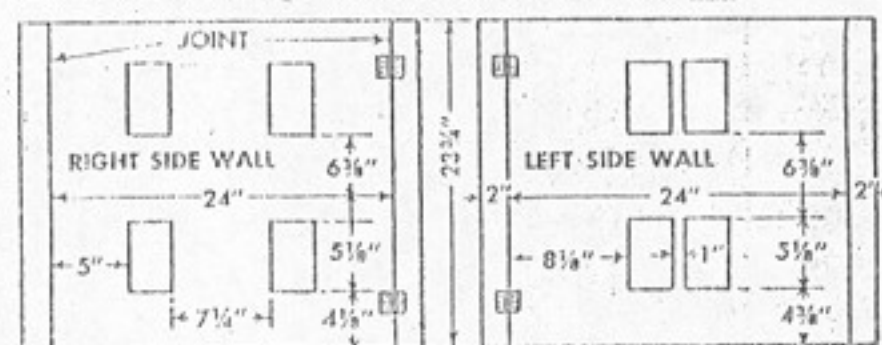
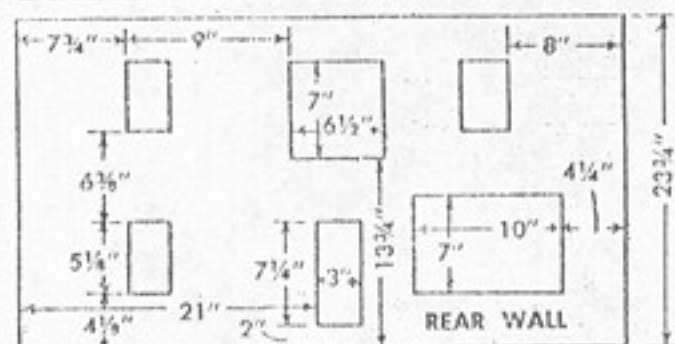
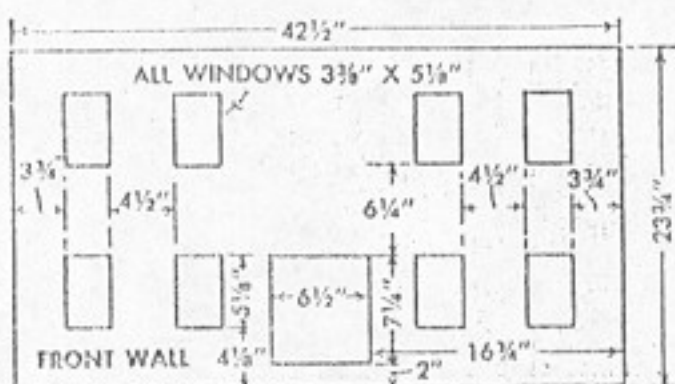
POPULAR MECHANICS
DECEMBER 1947

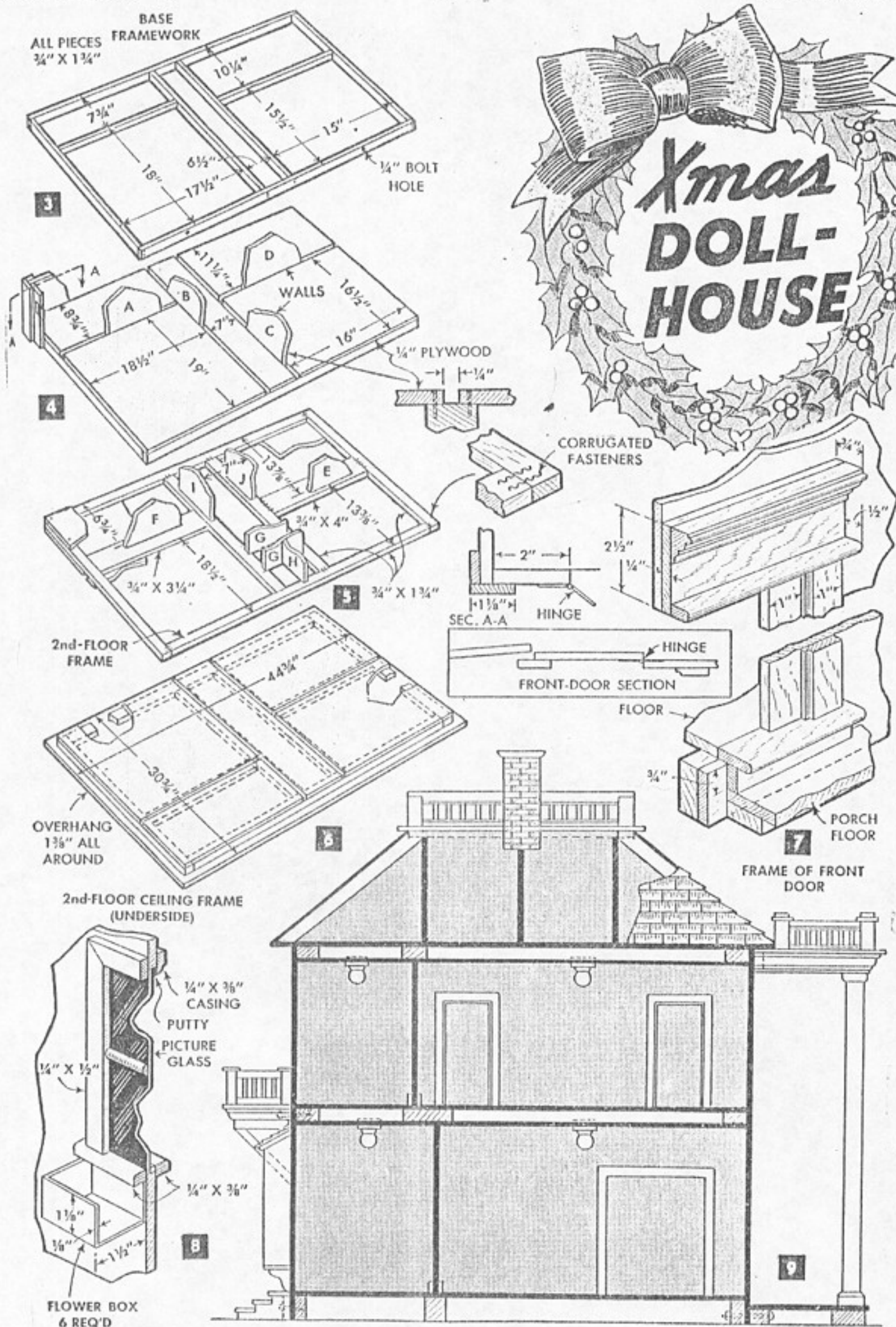


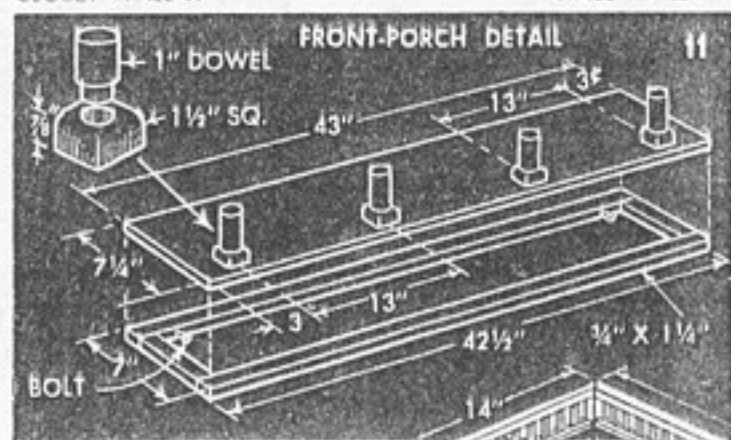
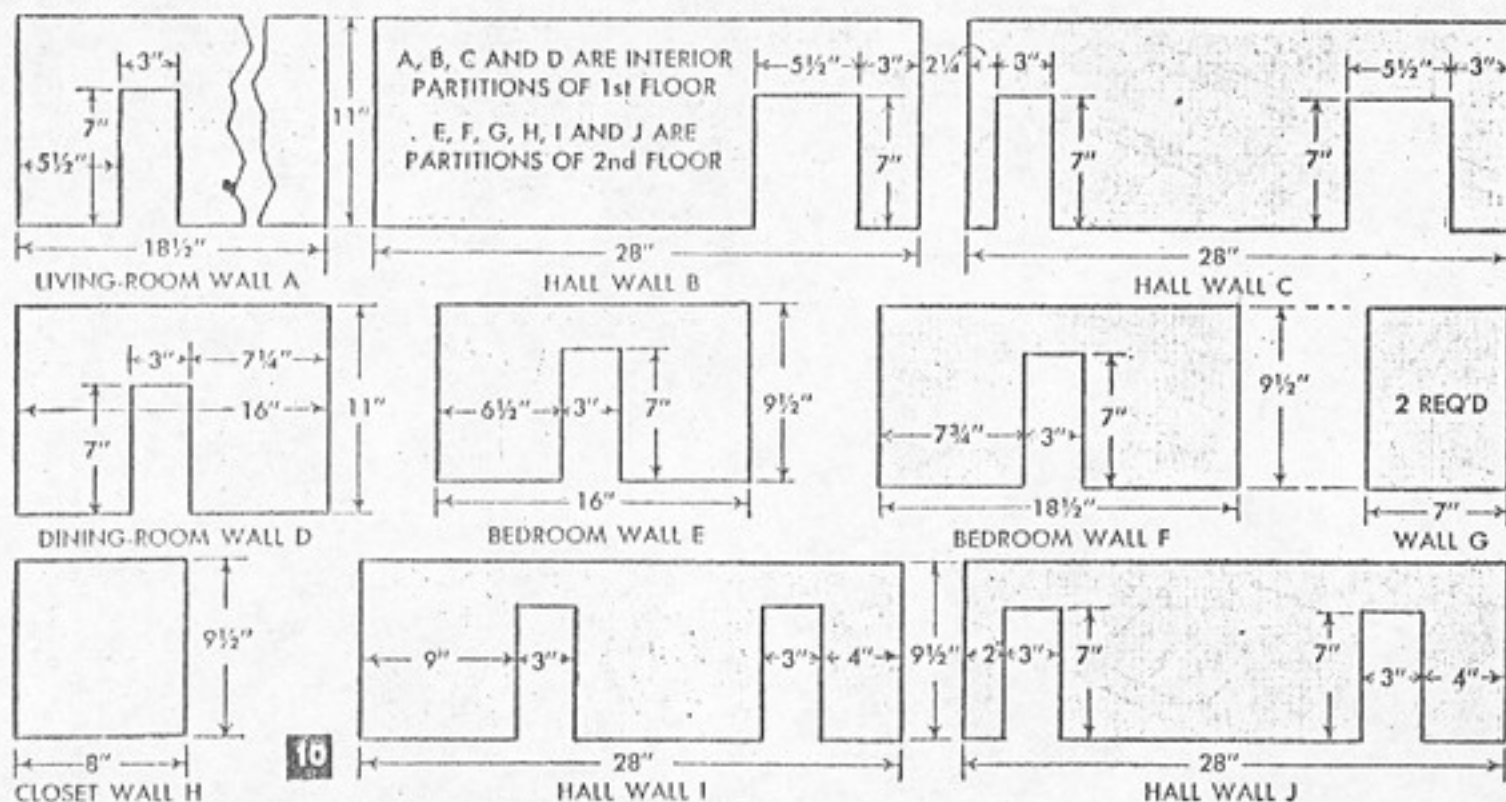
By Adam Trieschmann

MAKE THIS a Christmas some little girl will always remember by giving her this beautiful eight-room dollhouse. It's a replica of a colonial mansion complete with electric lights, fireplace and an open stairway. Both ends swing open for access to rooms upstairs and down as shown in Fig. 1. Made of plywood, the house measures $31\frac{1}{2}$ by $44\frac{3}{4}$ in., exclusive of porches and balcony. The rear stoop and front porch are detachable to permit the house to be carried through a 32-in. opening. If it is to be carried through a doorway of smaller width, the dollhouse must be reduced.

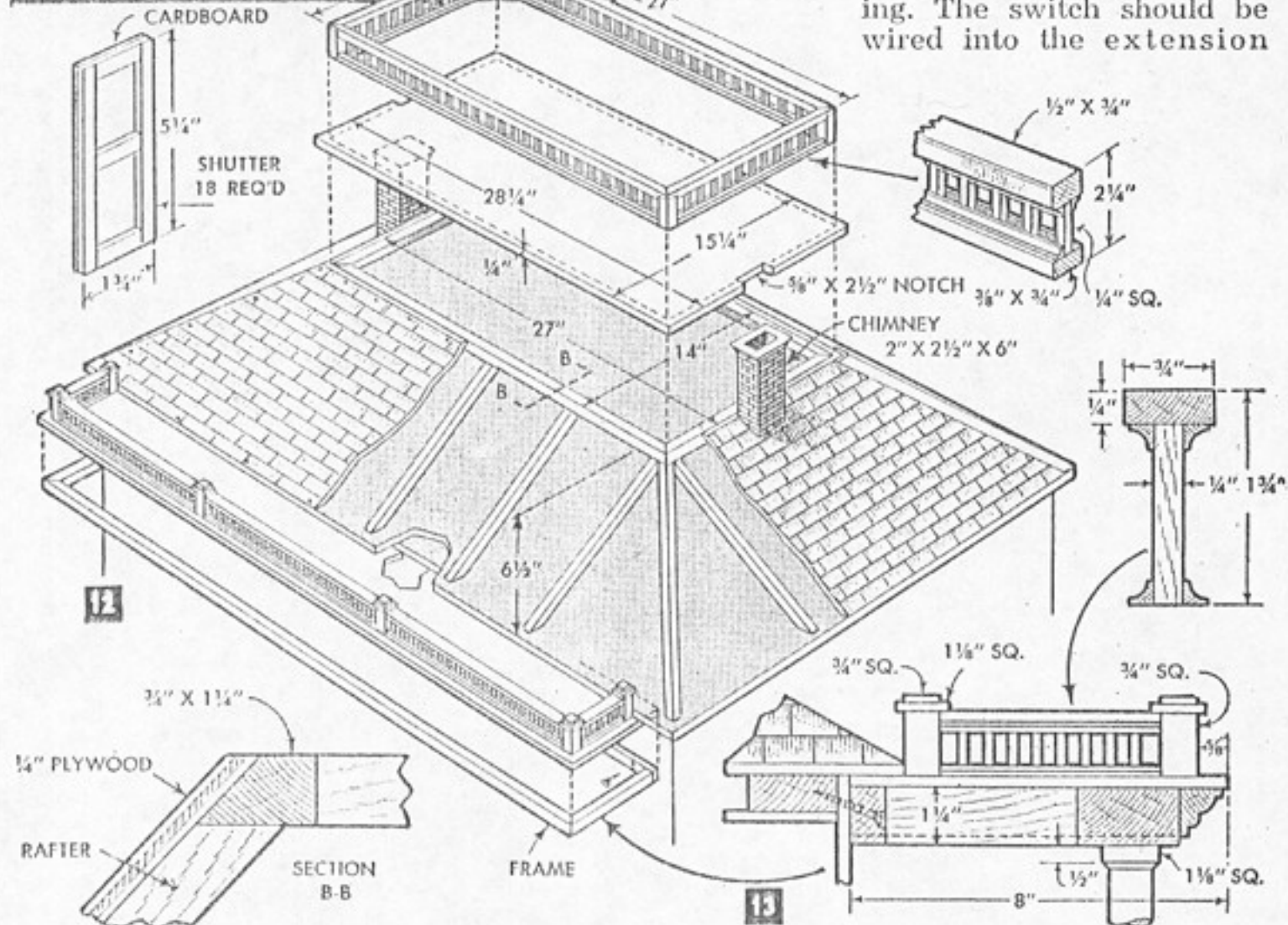
The first step is to make the base framework, Fig. 3. Pieces of solid stock, $\frac{3}{4}$ by $1\frac{3}{4}$ in., are used and are assembled with the pieces set on edge. Then the frame is floored with five pieces of $\frac{1}{4}$ -in. plywood, spaced as shown in Fig. 4 to form $\frac{1}{4}$ -in. grooves into which the interior walls are fitted. The second-floor frame, Fig. 5, is built up similarly, except that the frame members are placed flatwise, and wider cross members are installed for walls E and F. Both sides of this frame are covered after first installing electrical wires for the





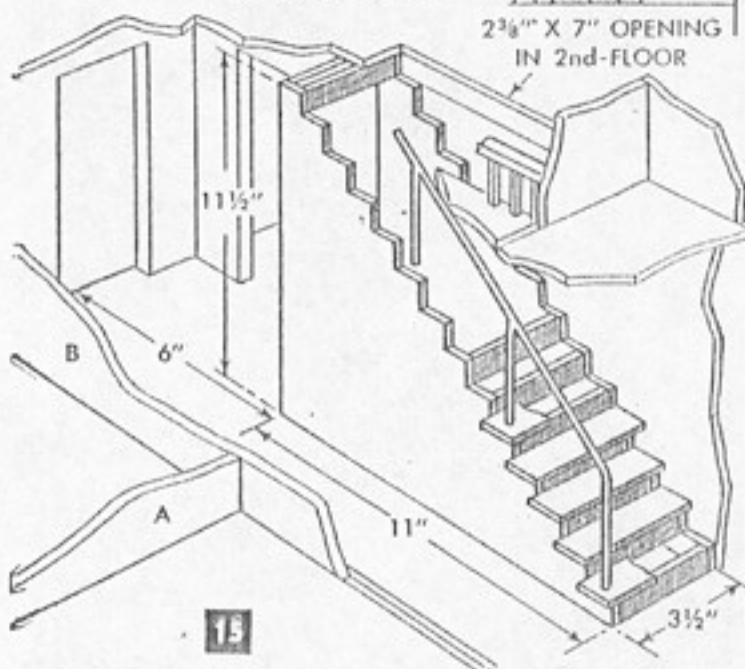
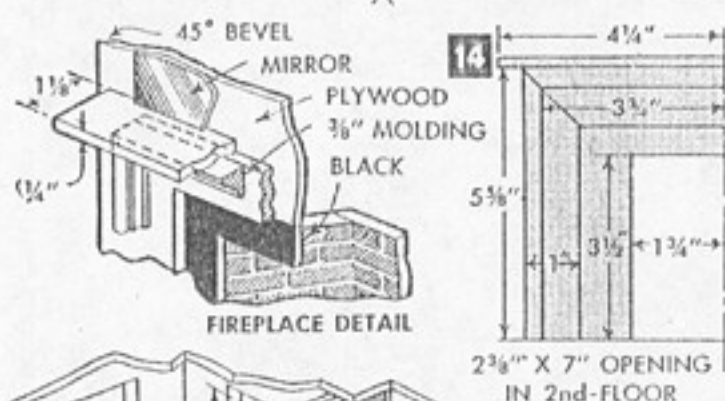
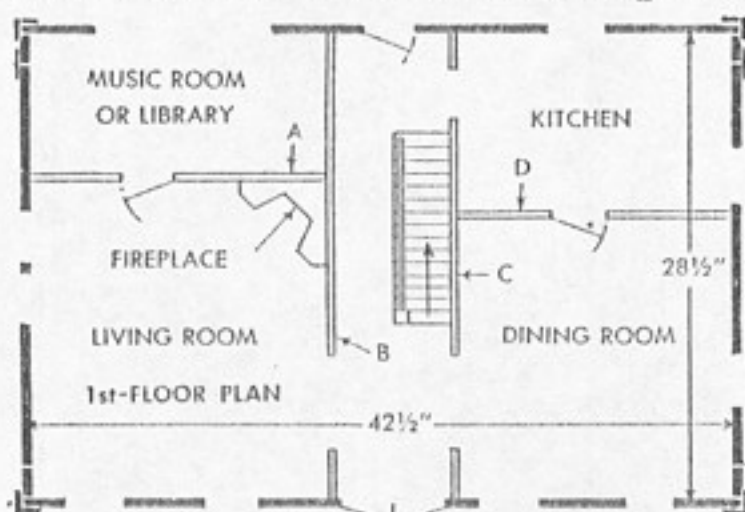


lights. Heavily insulated lamp cord will do for connecting the sockets, and all wiring is brought to a central terminal in the attic. A toy-train or bell-ringing transformer, which can be mounted in the attic or placed remotely from the house, is used to light 6-volt bulbs. Use a well insulated, rubber-covered extension cord from the 110-volt line to the transformer. A toggle switch to control the transformer is mounted in a corner of the bathroom ceiling. The switch should be wired into the extension

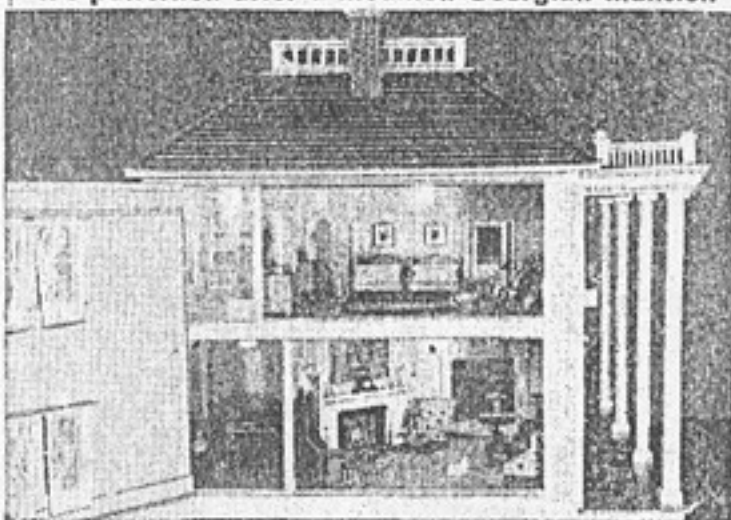


cord ahead of the transformer. Be sure that all connections are soldered and taped. Realistic light fixtures can be made by cutting off the base of 7½-watt frosted bulbs and using the top parts as globes. Or, an indirect lighting effect can be had by covering the hole for the bulb with a piece of frosted glass and mounting the bulb behind it. The ceiling frame for the second floor, Fig. 6, is shown ceiling side up. Note that the partition grooves must be spaced to match those in the top side of the second-floor frame. The top of the ceiling frame is covered with ¼-in. plywood, letting it project 1⅜ in. all around. Remember to include wiring here for second-floor lights.

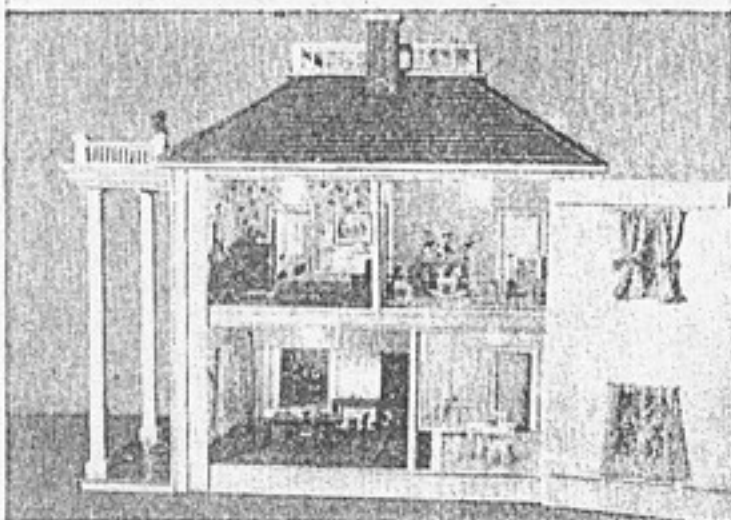
Cut the partitions, Fig. 10, next. Note that these are keyed with the floor plans to show where each one goes. The waste pieces from the door openings are saved and used as doors. These can be hinged to



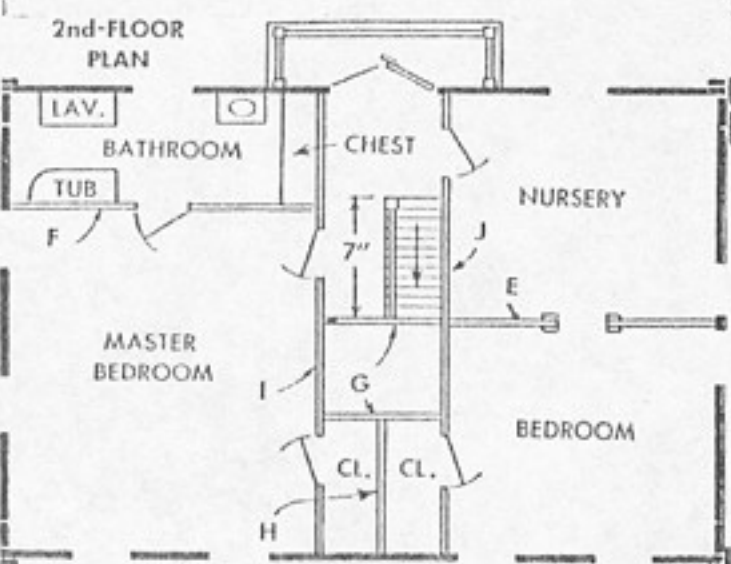
It's patterned after a modified Georgian mansion



Each side gives access to rooms upstairs and down

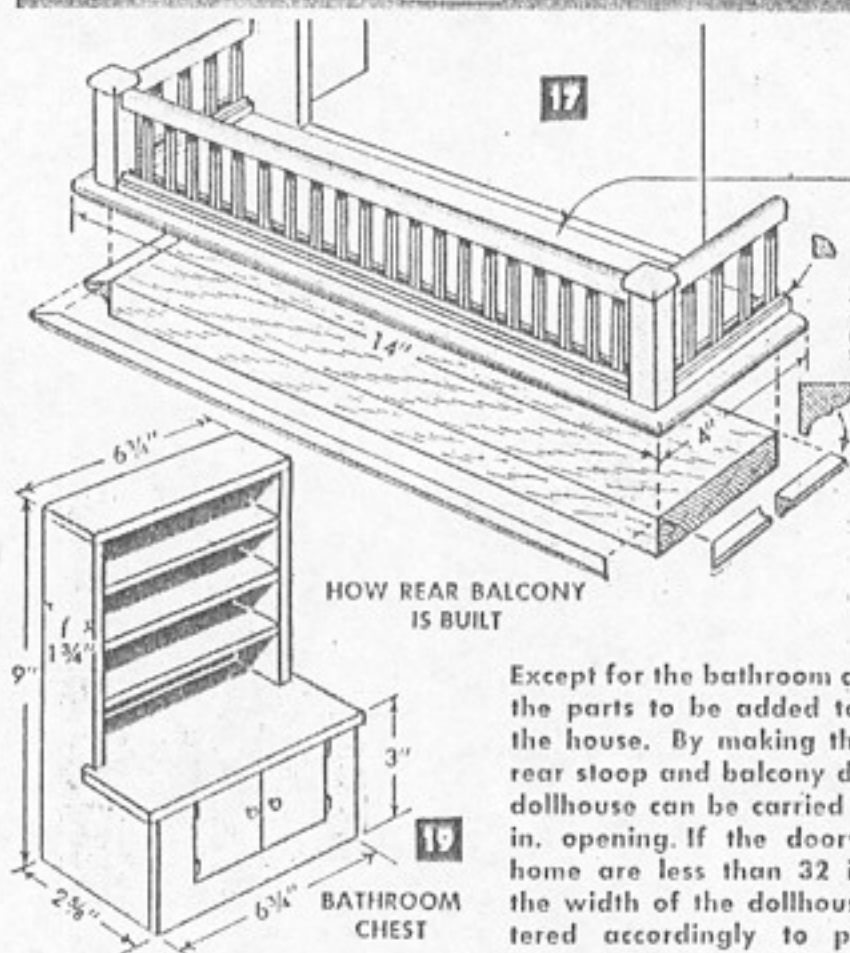


Side walls are hinged to opposite corners of house



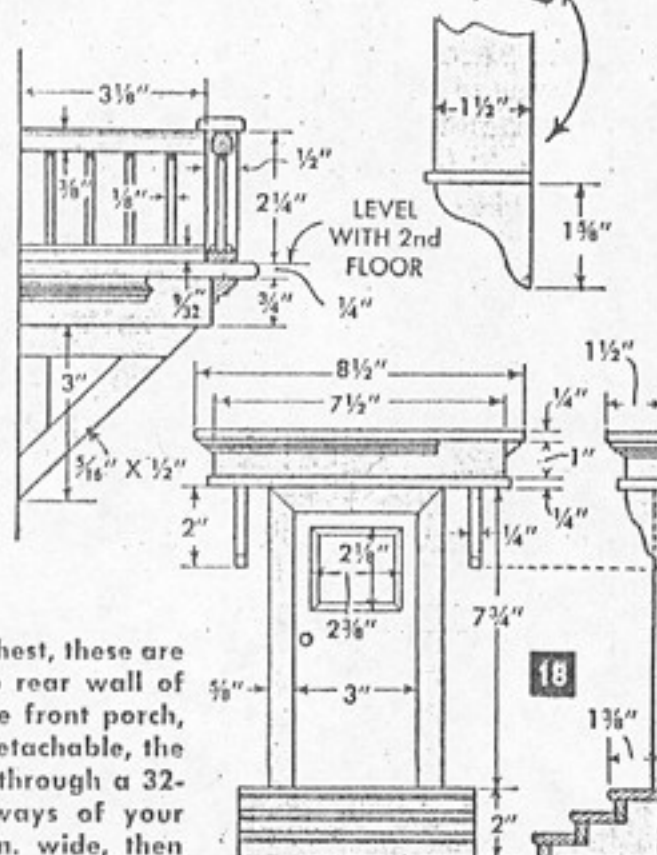


16 BAY-WINDOW DETAIL



HOW REAR BALCONY IS BUILT

Except for the bathroom chest, these are the parts to be added to rear wall of the house. By making the front porch, rear stoop and balcony detachable, the dollhouse can be carried through a 32-in. opening. If the doorways of your home are less than 32 in. wide, then the width of the dollhouse must be altered accordingly to permit moving



DETAIL OF REAR DOOR

actually swing, or they can be left ajar in a fixed position. Interior casing and base-board are $\frac{1}{2}$ -in. strips of cigar-box wood. Let the casing on one side of each opening extend $\frac{1}{8}$ in. to form stops for the door, and insert a fill-in piece in the exposed groove. It will be somewhat more convenient to decorate the interior if the partitions are painted or papered before they are glued in place. The open stairway, Fig. 15, must be installed as you go. This fits against wall C and requires cutting away a portion of a cross member in the second-floor framing to make it fit flush. The fireplace, Fig. 14, should be installed at this time, too. A piece of plywood, 10 in. square and having the edges beveled 45 deg., is fitted in a corner of the living room as indicated in the first-floor plan. An opening is cut in it first for a fire pit and then the lower half is faced with a mantel, the upper half with a mirror.

Exterior walls are dimensioned in Fig.

2. These also are of $\frac{1}{4}$ -in. plywood. The front and rear walls are fastened to the edge of the frames with flat-headed screws, letting them extend $\frac{1}{4}$ in. at each end and butting the top edge of the plywood against the roof overhang. A 2-in. strip is added to each corner, to which the side walls are hinged, and then each corner is finished with corner boards. See the sectional view to the right of Fig. 5. Small turn buttons can be used to keep the sidewalls closed. All windows are trimmed, inside and out, according to Fig. 8, and the front door is framed as in Fig. 7. Shutters are added to second-floor windows.

The hip roof is framed next. A 14 by 27-in. beveled frame is supported $6\frac{1}{2}$ in. above the plywood attic floor by $\frac{3}{4}$ -in. rafters and is roofed with plywood as in Fig. 12. Shingles can be of cardboard or wood, laid individually or in strips. Finally, the center of the roof is covered with a removable

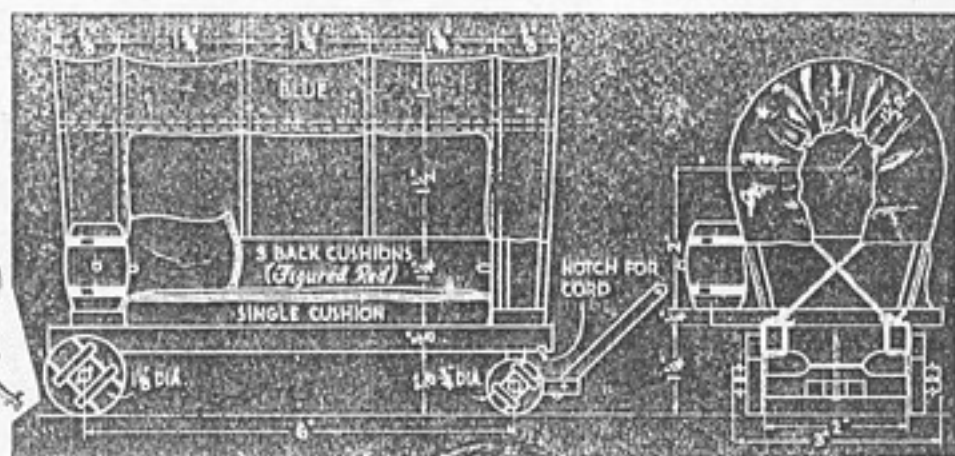
panel as shown, the railing fitted and the two chimneys added. Red paper ruled in a brick pattern with white ink can be pasted to the four sides of the chimney. Shingles likewise can be cut from colored cardboard, or painted later to suit. By first coating the shingled roof with a thin application of glue and then sprinkling fine sand on it when the glue is tacky, you can simulate real shingles. Where the shingles meet at

the hip line, cover the joint with a strip of cardboard folded in the center as shown.

Figs. 11 and 13 detail the porch and Fig. 9 shows how the porch floor is bolted to the house. This leaves the balcony, bay window and stoop to be added to the rear side of the house. These are detailed in Figs. 16, 17 and 18. The bathroom chest, Fig. 19, is located according to the second-floor plan.

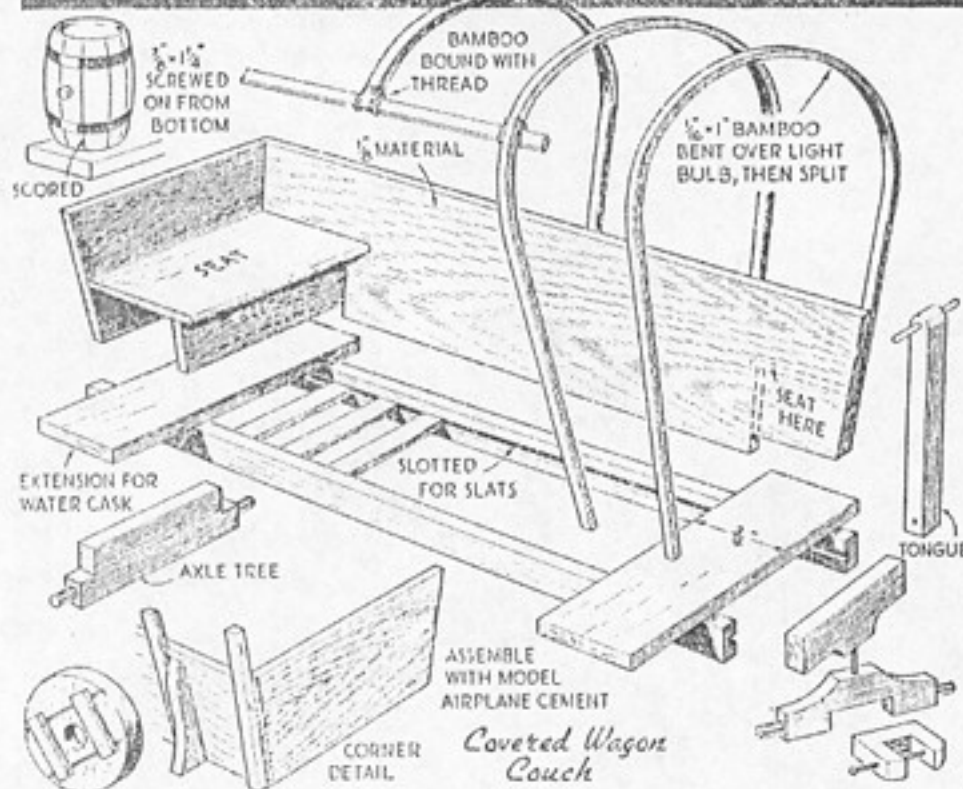


Mexican Patio Furniture for Children's Dolls

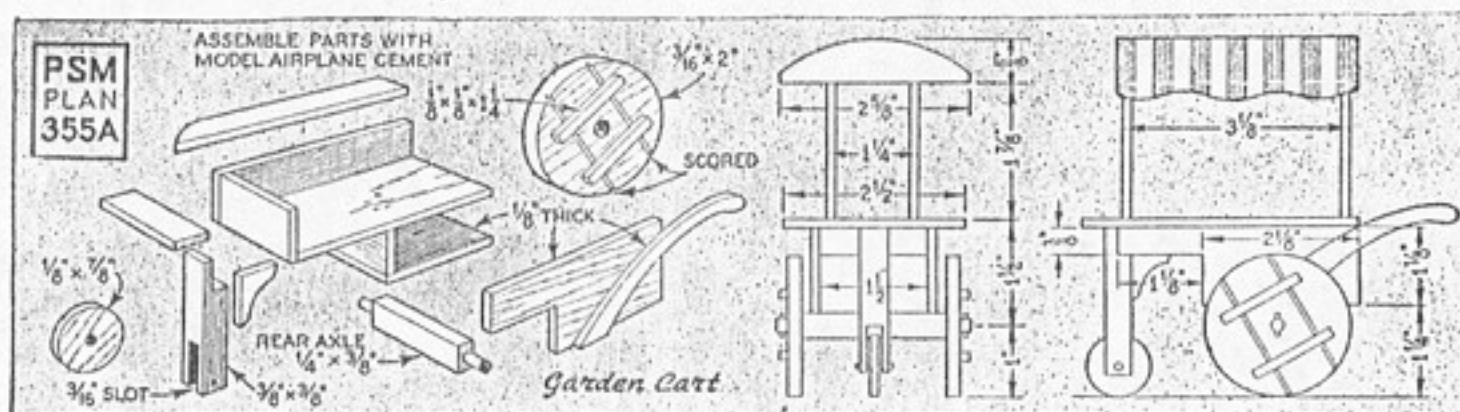


ILLIPUTIAN patio furniture in the popular Mexican motif makes a colorful setting for your daughter's dolls. The accompanying drawings show how a covered-wagon couch, roll-around couch, umbrella table, and garden cart are constructed. Model airplane cement is used to hold the parts together.

In building the covered wagon, make the axles loose enough so they will not stick after they are painted. The back is a single piece of $\frac{1}{8}$ " material. To bend the bamboo, hold it over a lighted electric bulb, then split and locate the bows as shown. The wheels are single pieces, scored to represent joints, with cleats cemented on. Turn the water cask on a lathe and screw to one of the cross members. The original was painted with



POPULAR SCIENCE DECEMBER, 1938



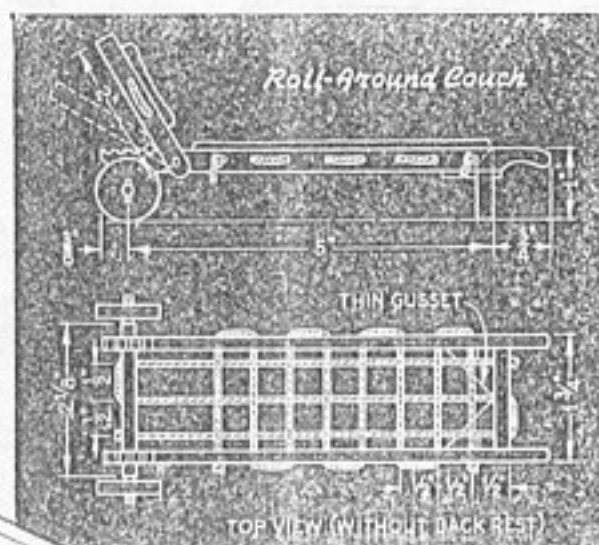
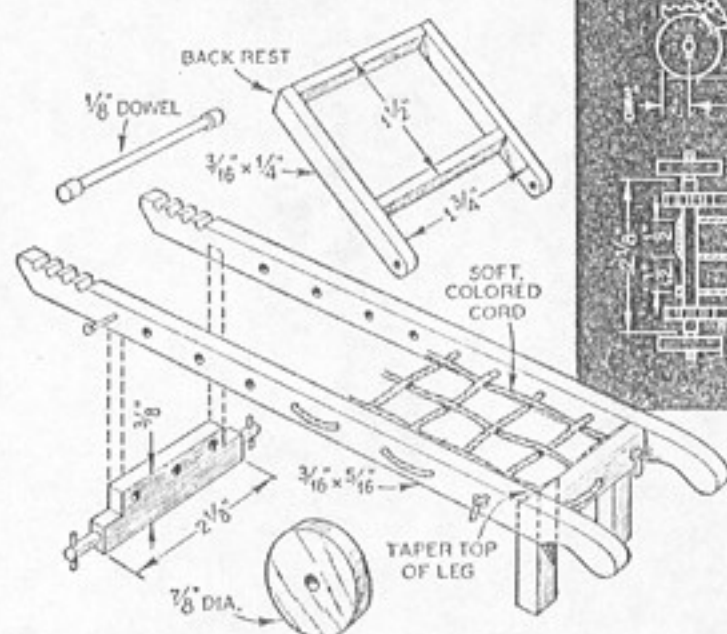
white brushing lacquer and the cask embellished with red hoops. Bright red-figured cushions and a blue top completed the wagon, but any color scheme may be used. Soft cotton cord is used for "pucker strings" at the ends of the canopy."

Construction of the other three pieces is simple. Use colored cord to match the cushions on the roll-around couch. Make the umbrella from tin because a cloth umbrella is a job for a needleworker and must be stiffened with buckram. The awning of the cart may be cloth or tin. A delicate Mexican flower-and-vine decoration may be added.

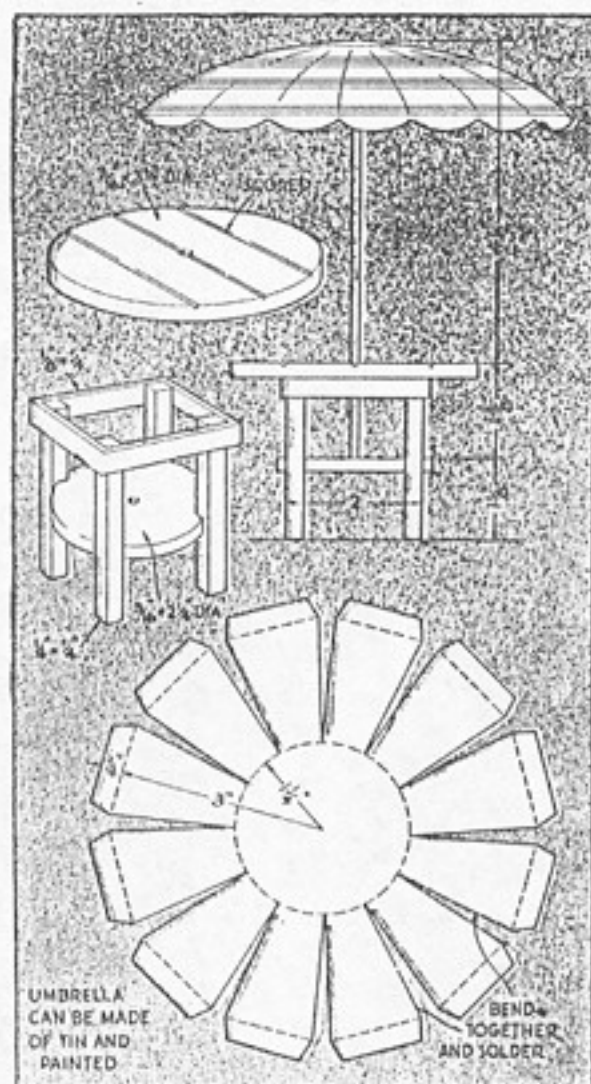
The same drawings may be used as a basis for full-size garden furniture. In that

case, let 1" equal 1' and use 2" by 3" pine for framing. Topbows of the covered wagon should be of spruce or hickory. Rope $\frac{1}{2}$ " in diameter is needed for the roll-around couch. Screws and waterproof casein glue

should be used.—
LOWELL R. BROWNE.

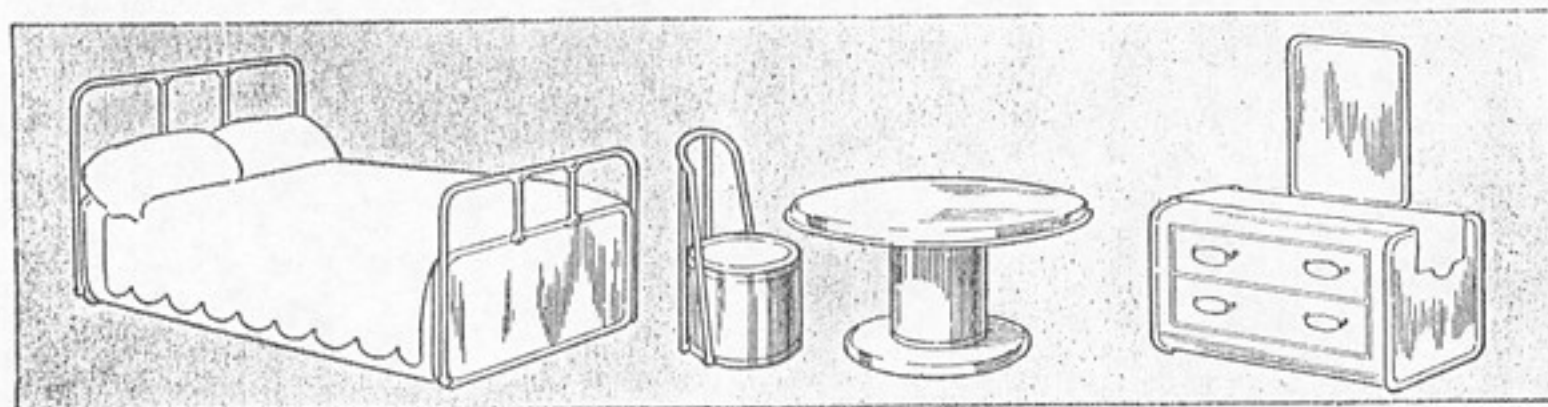


Drawings of the cart and a simpler type of garden lounge. All four pieces are scale models and can be constructed full size, if desired, for garden use



Tin Cans Turned into Toy Furniture

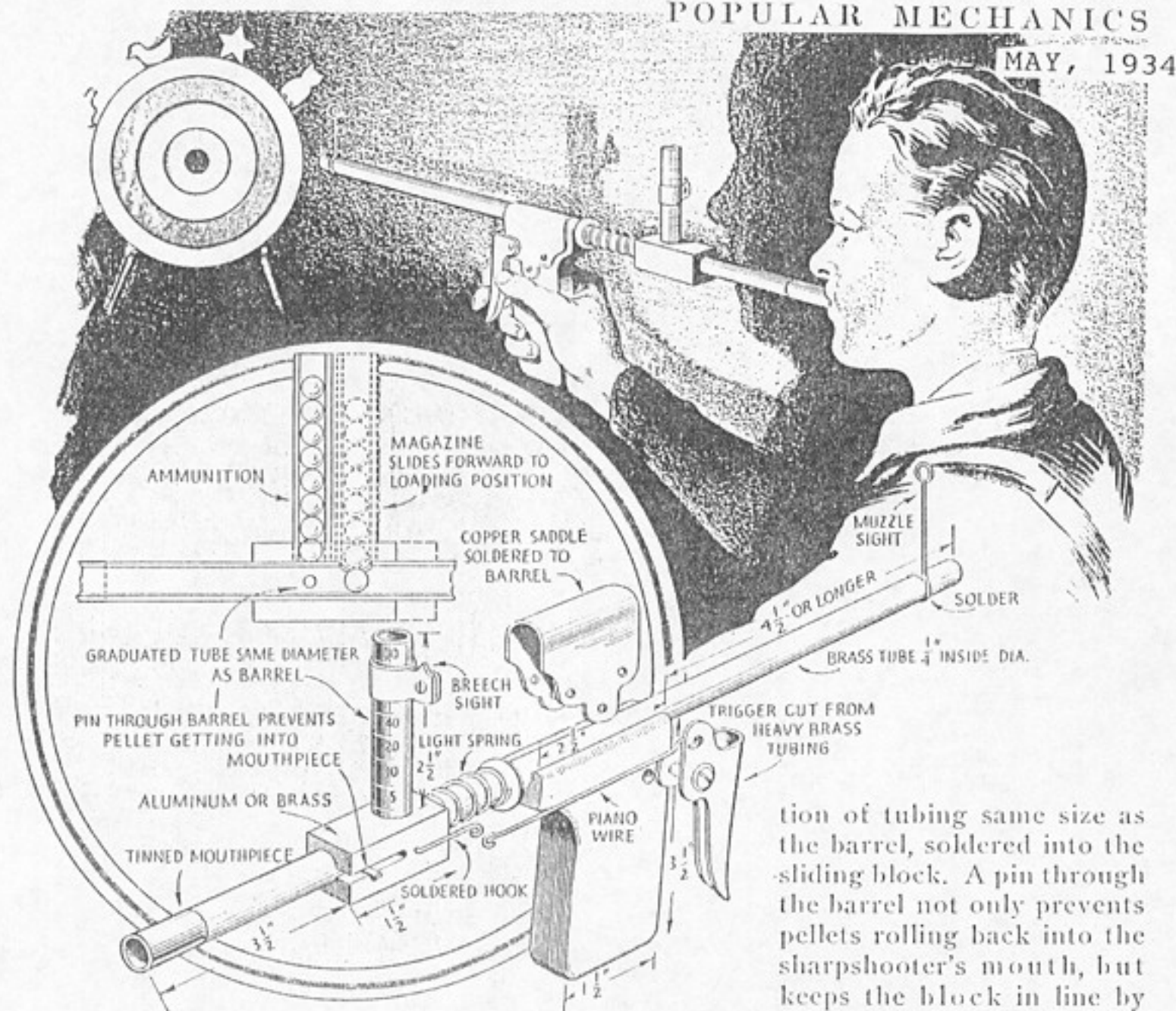
WITH the aid of solder and a few pieces of heavy wire, you can transform empty tin cans into toy furniture that will please any little girl. One half-pound and two one-pound cocoa cans are needed for the bedroom suite. The dresser is the smaller can with the bottom cut from a large can soldered in place for a mirror. Reinforce the joint in back with a loop of stiff wire. Fasten four beads to the front of the dresser to represent drawer pulls by running fine wire through holes punched with a nail. The chairs are small condensed milk cans with backs built of wire. The table is the lid of a gallon syrup pail, a slender can, and a medium-sized lid.—HAZEL F. SHOWALTER.



This Super Bean Shooter Has a Magazine

POPULAR MECHANICS

MAY, 1934



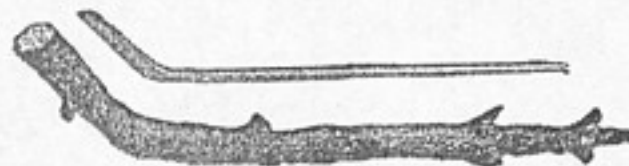
Here is a long-range gun that almost gets into the naval class of artillery, and shoots a surprising distance with great accuracy. Although it falls in the classification of a bean shooter, it is designed to use pearl tapioca pellets for ammunition and is quite harmless, since these are neither as hard nor as heavy as beans. They are ideal for the purpose because they are round and slide easily through the $\frac{1}{4}$ -in. barrel, which may be 24 in. long. The mouthpiece of the barrel should be tinned with solder because of the unpleasant taste of the brass tube. Mount the barrel on a wood hand grip as shown, after the magazine has been fitted. The latter consists of either a brass or an aluminum block drilled to fit over the tube so that it slides easily but without any play. The magazine is merely another sec-

tion of tubing same size as the barrel, soldered into the sliding block. A pin through the barrel not only prevents pellets rolling back into the sharpshooter's mouth, but keeps the block in line by means of the slots. The hole in the barrel through which the ammunition feeds should be amply large enough to prevent jamming. Graduations for the rear sight must be marked by trial.



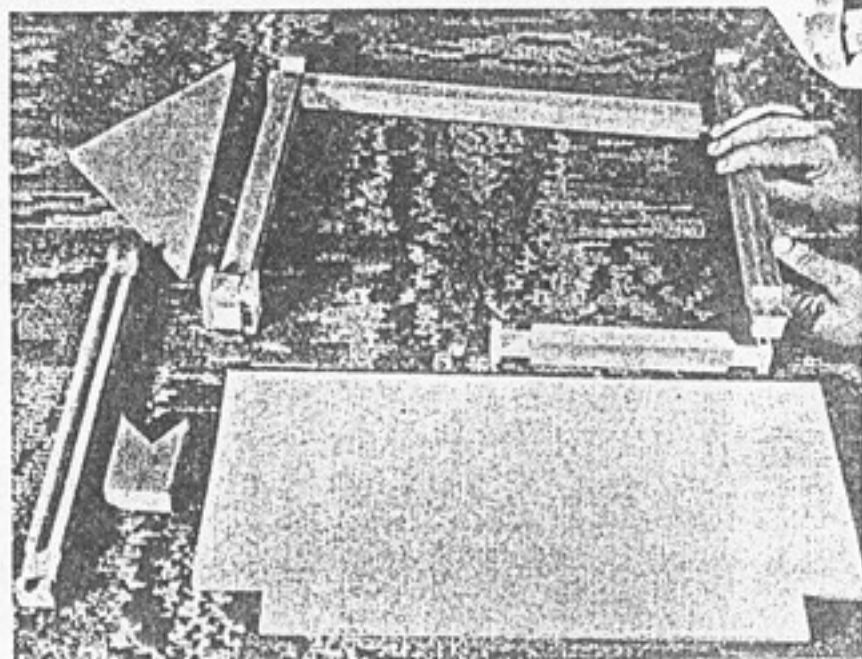
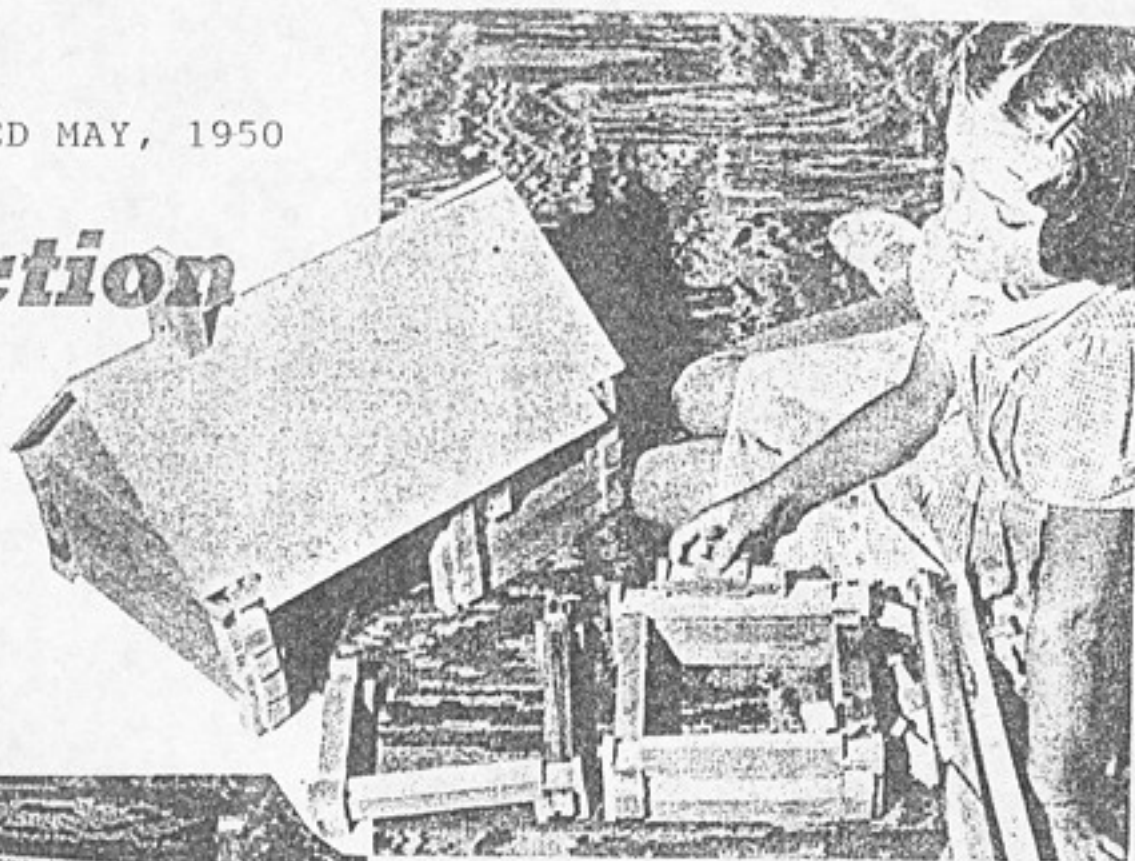
A HOCKEY STICK

Select an elm branch shaped as illustrated. With a spokeshave, plane, rasp, and sandpaper, finish it to the following dimensions: shaft, 50 inches long, tapering from a diameter of three-fourths of an inch at the handle to five-eighths of an inch at the other end; blade, 12 inches long, two and one-fourth inches wide, three-eighths of an inch thick at the bottom, three-sixteenths of an inch thick at the top.



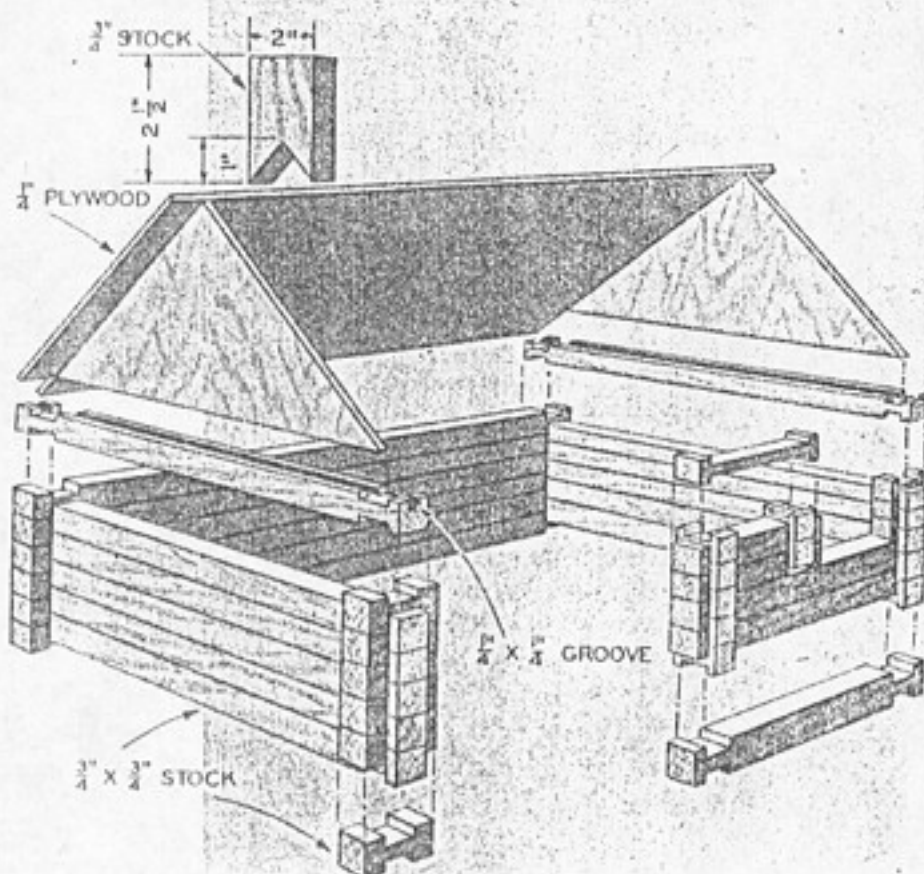
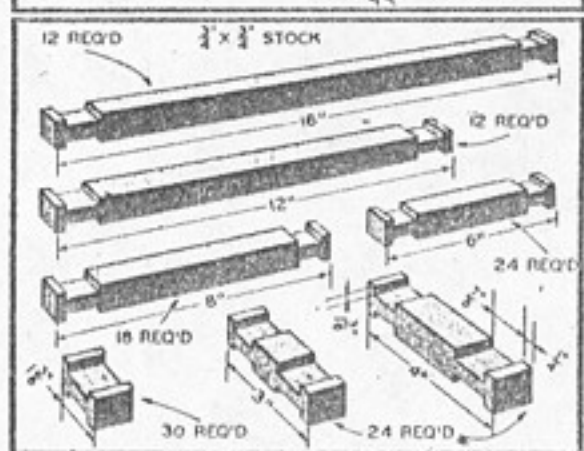
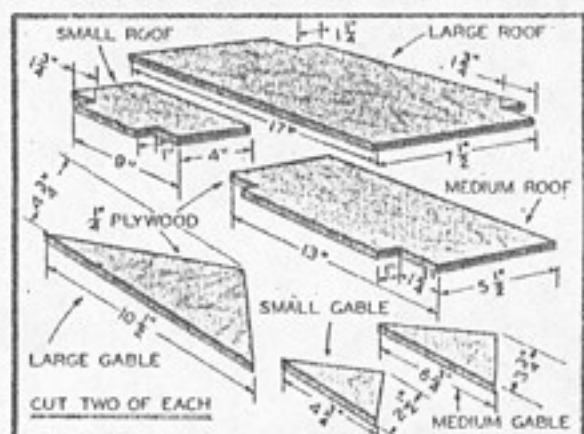
MECHANIX ILLUSTRATED MAY, 1950

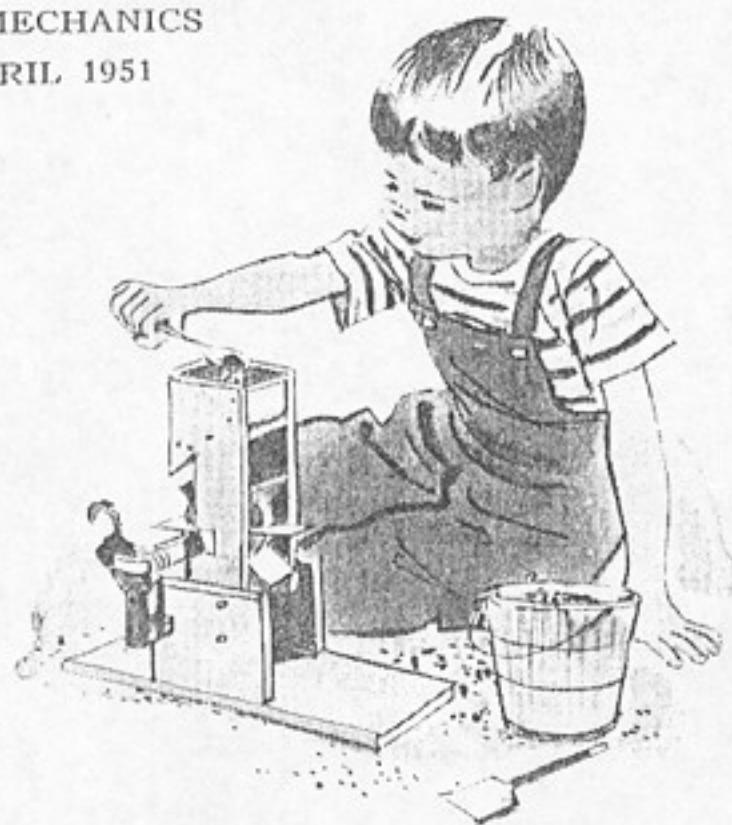
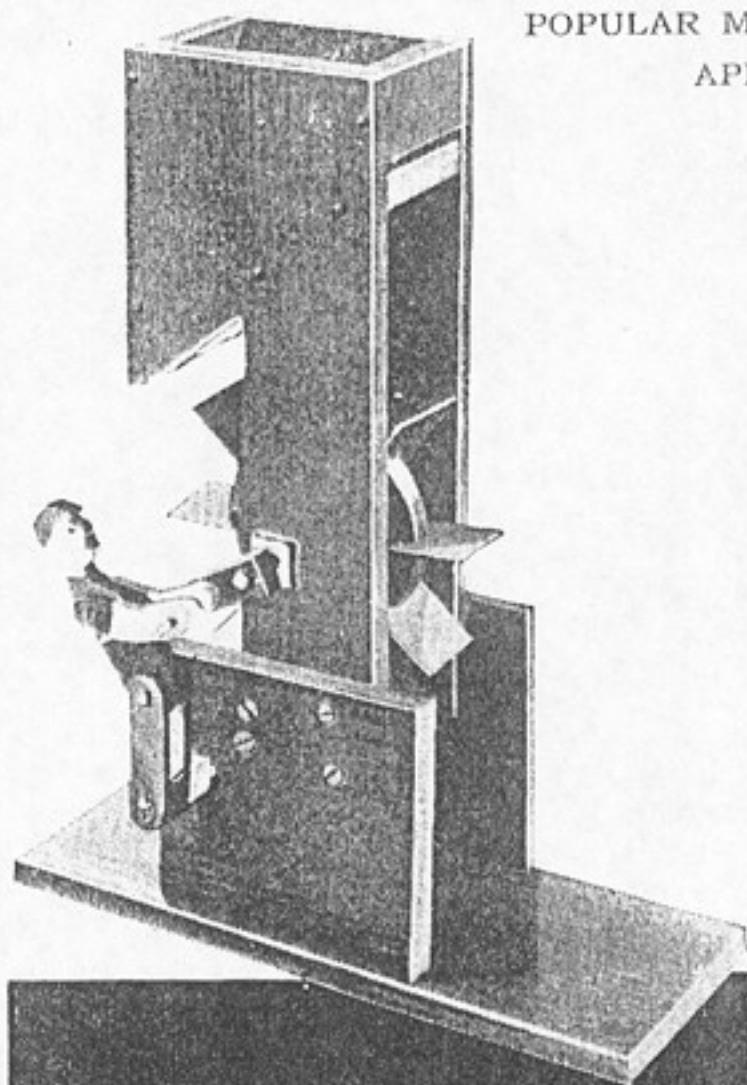
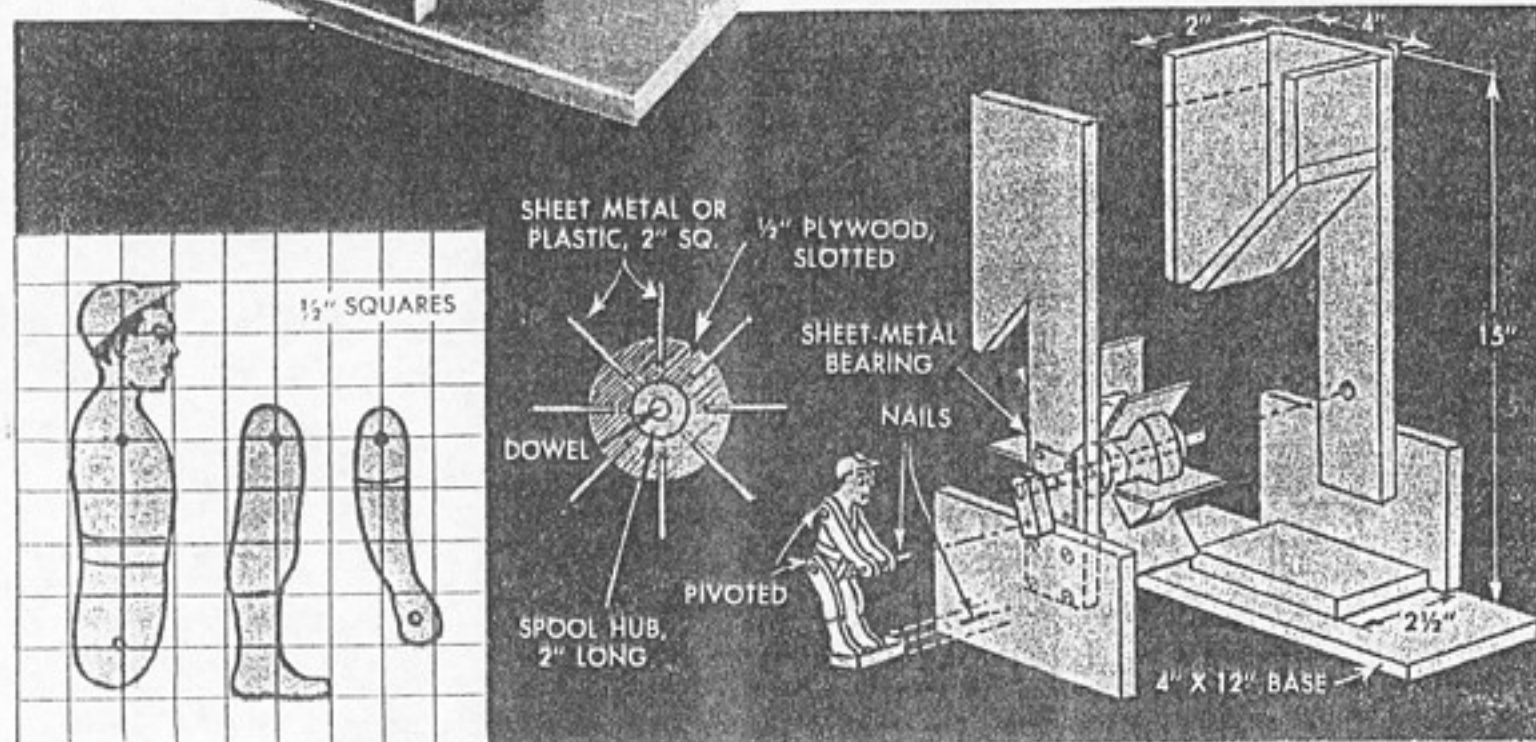
construction blocks for the kiddies



BRIDGES, forts and houses can be assembled in endless variety by the young construction engineer from this set of interlocking blocks. The basic pieces are $\frac{3}{4}$ in. square hardwood stock of various lengths.

On the $\frac{3}{4}$ in. square blocks a dado is cut both top and bottom $\frac{1}{4}$ in. from each end. Two each of the 12 in. blocks, 8 in. blocks and 6 in. blocks have grooves $\frac{1}{4}$ in. deep and $\frac{1}{4}$ in. wide cut lengthwise. These take the gable pieces. Chimneys are $\frac{3}{4} \times 2$ in. •



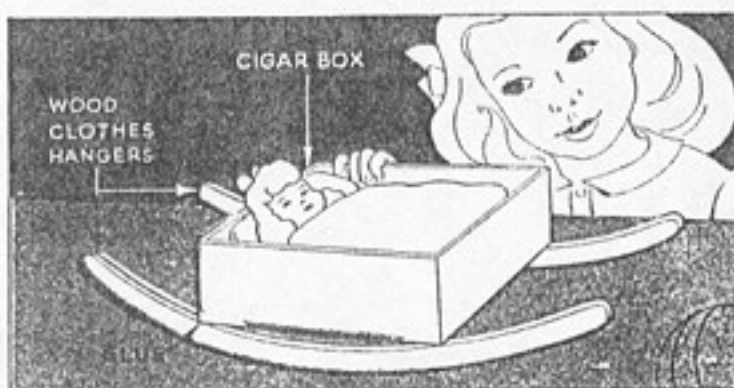
*Sand Toy***SAND TOY**

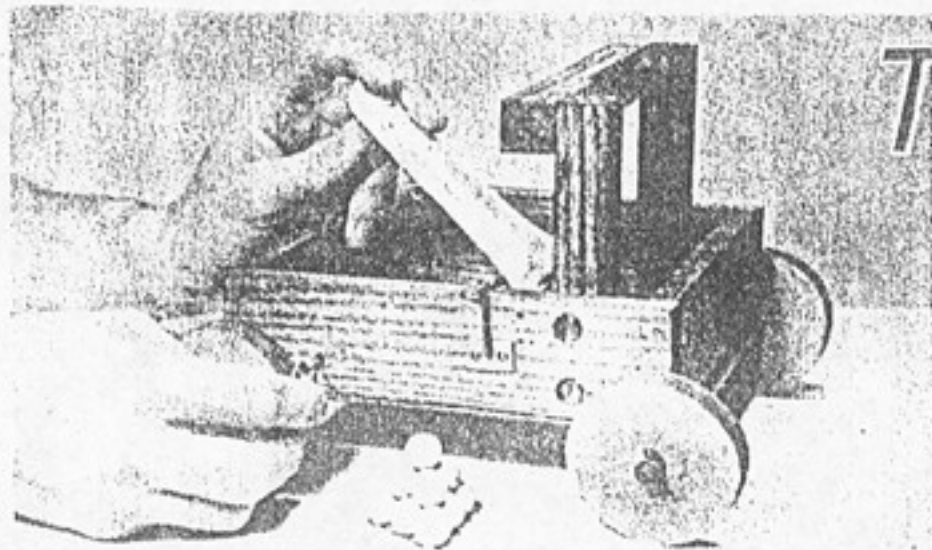
Youngsters will spend many an hour pouring sand into the toy hopper just to see the little man busily crank the paddle wheel. Made entirely from scrap wood plus

a few squares of sheet metal or plastic for the paddle-wheel blades, the toy can be cut out and assembled in an hour or two.

A "Quickie" for the Baby

A CIGAR box and two wooden coat hangers are all you need to make a cradle for your daughter's doll. Simply remove the lid from the box and the wire hooks from the hangers. Then fasten the box onto the hangers with wire brads and glue, as shown at right. For a more solid job, you can mount the hangers flat against the sides of the box.

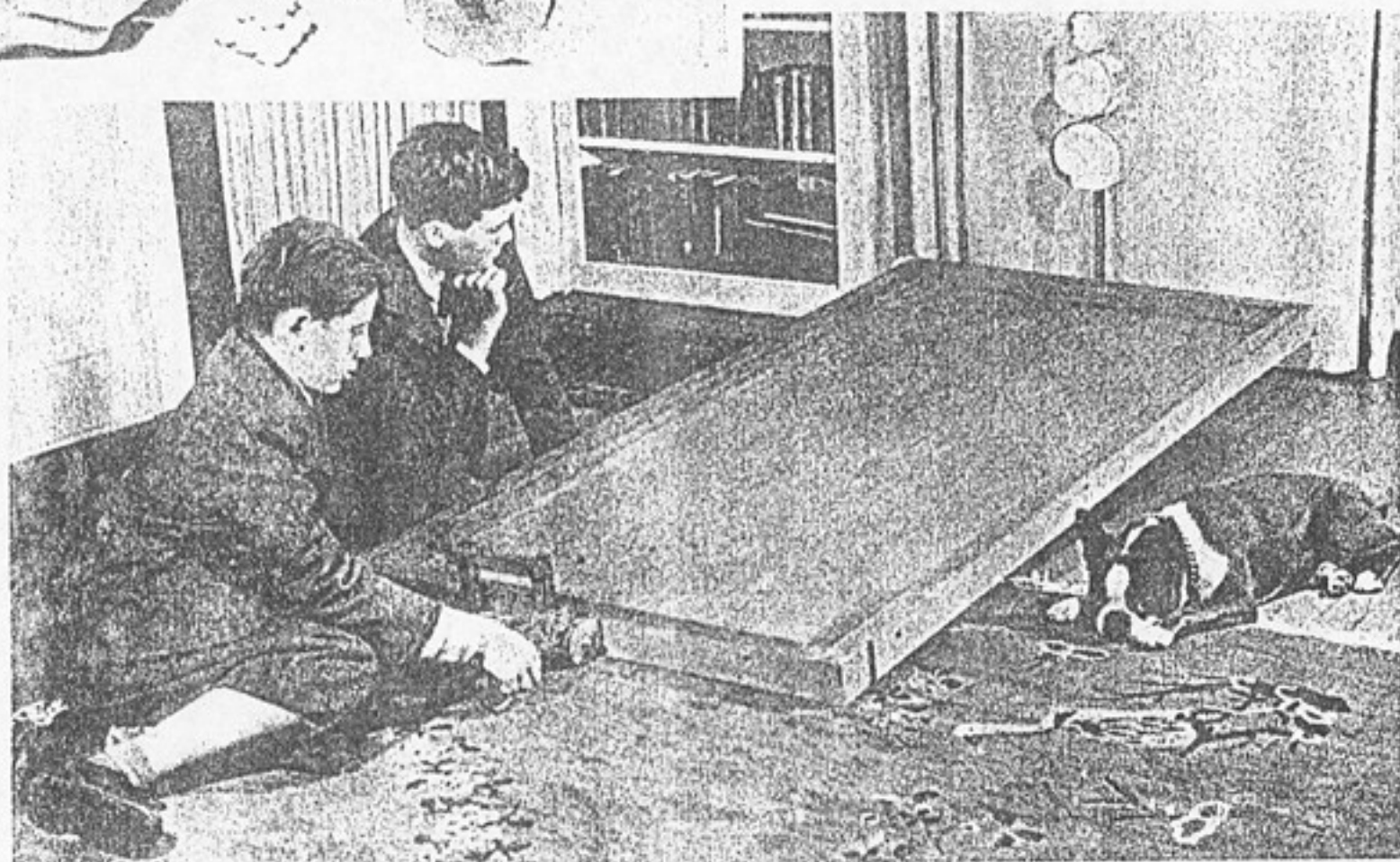




Toy Catapult

Realistic copy of the ancestor of mobile field pieces.

by Charles and Bertram Brownold



Top: Closeup of the catapult, with pile of ammunition alongside. Above: A handy rig for target practice. Inclined board returns shots that miss cans.

Mechanix Illustrated October, 1942

THE catapults of the ancient Greeks and Romans were huge and powerful engines of war, built of massive timbers. They were used to hurl rocks over the walls of besieged cities, and while the records are not clear as to the range they possessed, there is no doubt about their being able to throw huge missiles. Research scholars tell us that occasionally they were used to throw dead horses into the beleaguered town in the hope of starting a pestilence.

The throwing arm of the catapult was eight to ten feet long, and the motive power was supplied by a twisted skein of animal sinew about a foot thick. The catapult was built like a four-wheeled cart, and the skein of sinew passed through the cart's sides and was twisted in a forward direction by means of long, crowbar-like levers in the hands of the

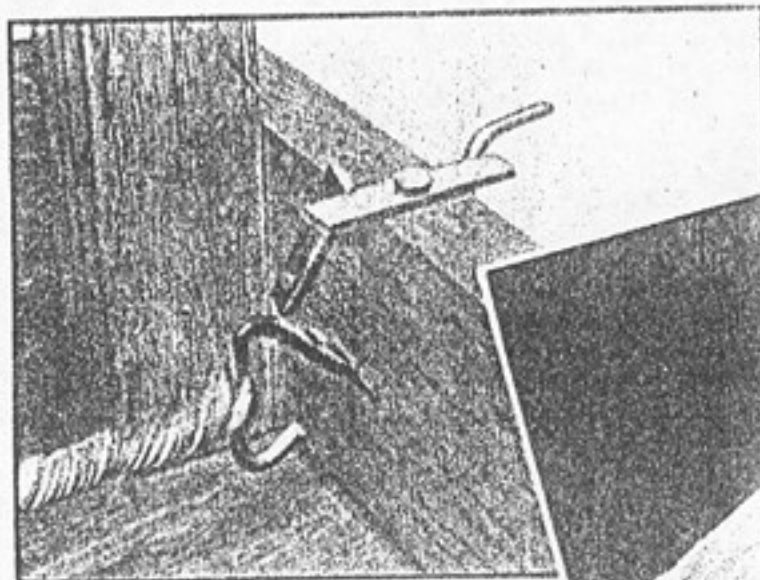
primitive artillerymen. A crude ratchet prevented the skein from unwinding. The throwing arm was thrust through the center of the skein and was fitted with a wrought iron eye so that it could, by means of rope and pulleys, be pulled down against the twist of the skein, and held in a horizontal position for loading.

Some of the throwing arms were fitted with a leather sling in which the missile was placed, and some had a cavity that received a boulder.

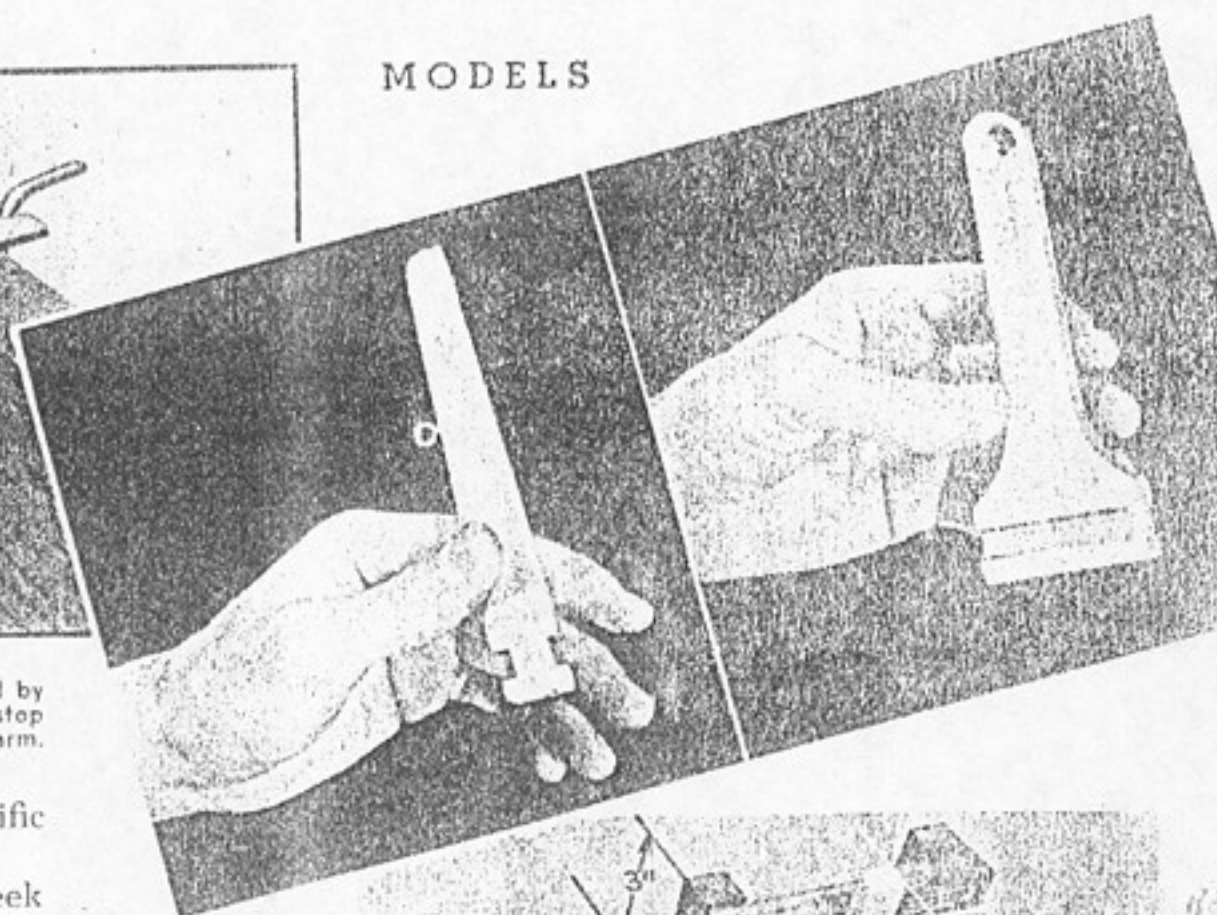
After loading, a hook that engaged the eye in the arm was released and the arm flew up and forward, describing a ninety degree arc, at the end of which it was brought to an abrupt stop by striking a bumper built into the forward end of the cart. At the moment of impact the missile flew from the sling or

Is Model of "Roman Artillery"

MODELS



Above: Skein of rubber bands is held by hook through side of cart. Note stop latch. Right: Two views of throwing arm.



from the cavity with terrific force.

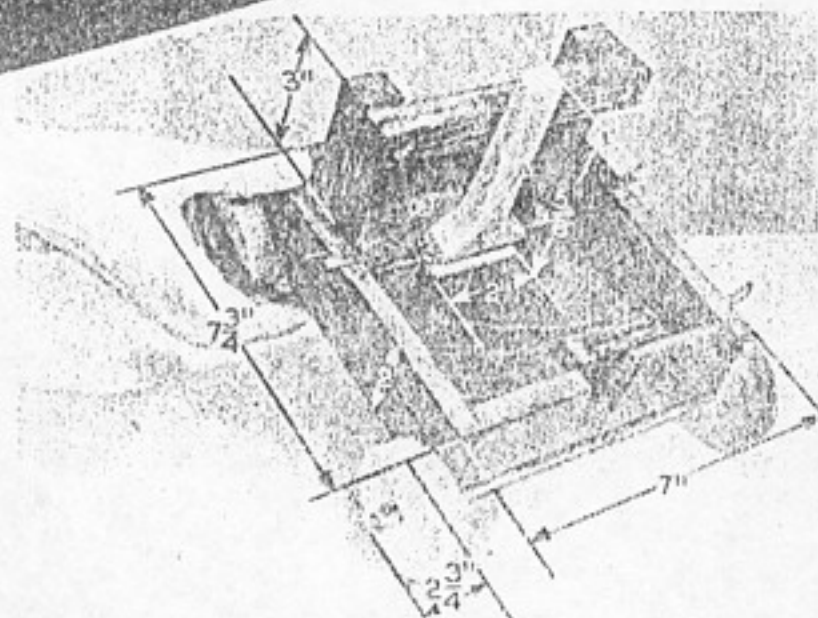
The efficacy of the Greek catapults depended upon the proper selection and processing of the sinews that made the skein. When the Romans conquered the Greeks they copied their catapults and used them to smash through the various Maginot lines of their day on their march toward world conquest.

The toy catapult described here is a copy in miniature of one of these ancient blitz weapons. It's fun to make and use and has surprising "fire power."

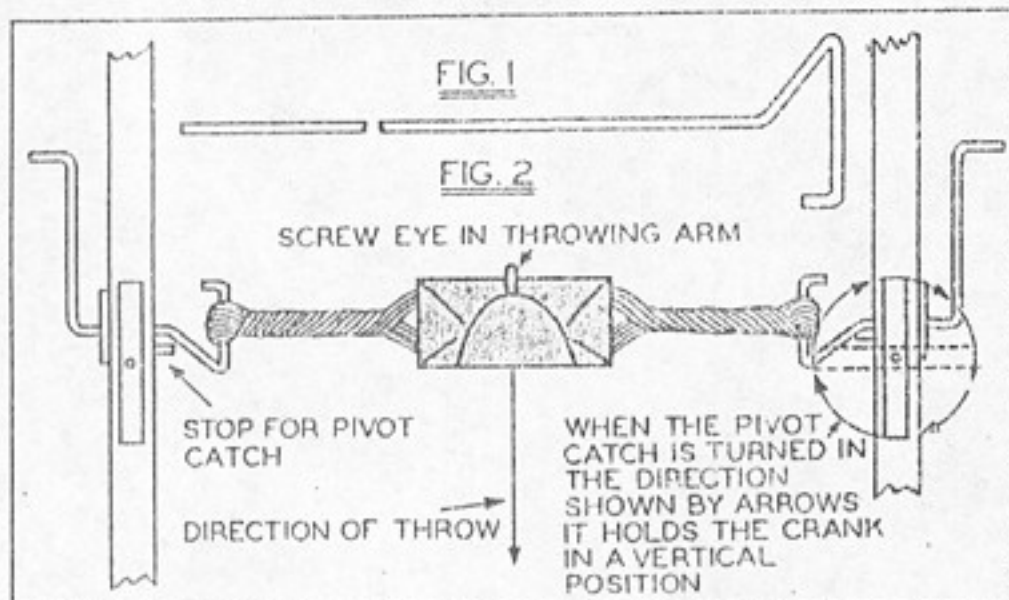
The part to make first is the throwing arm. This should be shaped like the one shown in the accompanying photographs, and its size is governed by the size of the ball one intends to use as a missile. It should be tapered so that the end with the cavity is as light as possible. This makes for a lively catapult.

After the arm has been carved, the cart with its bumper can be built the correct size to accommodate it. The catapult in the photographs was built to throw solid rubber balls $\frac{5}{8}$ " in diameter. Another good ball to use is the little wooden ball sold in five-and-ten-cent stores with various toy games, such as croquet.

The projectile force of the toy catapult



Dimensions given above are for a catapult throwing a ball of $\frac{5}{8}$ " diameter. Size should be varied according to diameter of intended ammunition. Guide for establishing other dimensions will be found at end of text. Below: Details of arm.



comes from rubber bands twisted in the same way that the ancient Greeks twisted the skein of sinew. Bend a piece of stiff wire into the shape of a hook as shown in Fig. 1. This hook has an opening large enough so that rubber bands can be slipped into it easily and so that they can be replaced if they break.

Two of these hooks are needed. Next drill two holes in the sides of the cart and reinforce the holes with metal plates as shown in the photos. Thrust the straight shanks of the hooks through the holes from inside the cart, and bend into cranks on the outside.

An improvised pivot-catch of scrap metal on each side of the cart will hold the cranks when the twisted rubber bands are fastened into place.

The rubber bands are stretched between the hooks. They should not hang loosely. If they do, double them. The correct number of bands to use can be determined by experiment. In the original catapult the rubber bands, when tightly twisted, formed a skein slightly thicker than a lead pencil.

Next, force the throwing arm between the rubber bands. The same number of bands should be on each side of it and all the bands should lie in the grooves cut into the lower end of the throwing arm to receive them.

Now twist the rubber bands by means of the wire cranks, being sure to give both cranks the same number of turns. The direction of the twist is such that at the top of the stroke the hand is moving forward. Turn until plenty of resistance is felt. This will make a "peppy" catapult. Then lock the cranks in position by means of the two pivot catches. For details of cranks and pivot catches see Fig. 2.

The catapult is now ready for loading. Pull the throwing arm back until it is horizontal and hold

it in that position by means of a piece of stiff wire thrust through the side of the cart from the outside. This wire passes through a staple in a block fastened to the floor of the cart and into the screw eye in the back of the throwing arm. When the wire is withdrawn the catapult shoots.

A good target for the catapult can be made from tin cans of various sizes nailed to a stick. The cans are partially filled with absorbent cotton so that the ball does not bounce out, but remains in the can. The score on the tin can target shown in the photo is 5 points for the large can, 10 points for the middle can, and 15 points for the small can. Each player has six shots each time he is up, and the winner is high man after six rounds.

It will be found that a sheet behind the target will keep the balls from bouncing all over the room, while a piece of plywood with "side rails" will cause the balls to roll back to the catapult.

Toy Catapult Dimensions

In further reference to the dimensions, as explained, the size of the ball that is used as a missile governs the size of the whole catapult.

The arm itself is nine times as long as the diameter of the cavity. Thus in the catapult illustrated, the cavity is $\frac{5}{8}$ " in diameter, while the arm is $5\frac{5}{8}$ " long.

The heavy lower end of the arm is two inches wide, and the inside width of the cart is three times this—or 6".

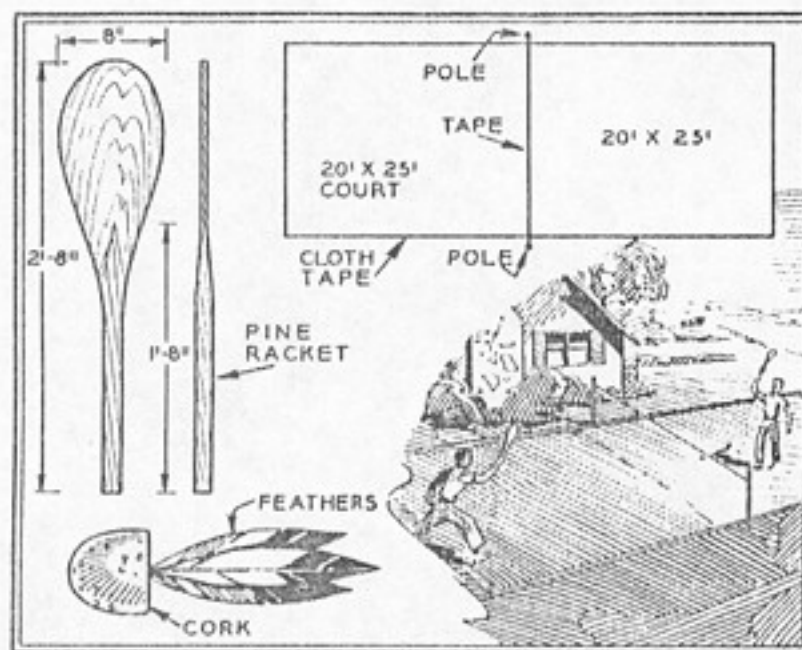
The bumper that stops the arm is just high enough so that the ball can clear it with about $\frac{1}{8}$ " to spare.

The length of the cart is slightly greater than its width.

If a catapult that is larger or smaller than the one illustrated is contemplated, it would be advisable to keep all of its parts in about the same size relationship one to another as the ratio given here. Slight variations, however, will not matter. This gives the amateur craftsman a little leeway in the use of scrap material.

SHUTTLE-COCK GAME

YOU can make the equipment for this lively lawn game in a short time, using strips of white cotton cloth, two boards, some feathers and a cork. Saw out the rackets from soft pine boards, planing down the blade of each racket to $\frac{1}{4}$ " thickness and rounding the handle. Each racket is 32" long and 8" wide. The shuttle-cock is a large cork, one end rounded and the other fitted with several chicken feathers. Bind the feather quills together with cord, cover with glue and sink them snugly in the cork. The rackets can be painted a bright color, and the cork and feather tips dyed to match. The court area is 20' by 50', and is divided in two by bamboo poles set in the sod at the sides, and connected by a taut cotton tape 2" wide, placed five feet above

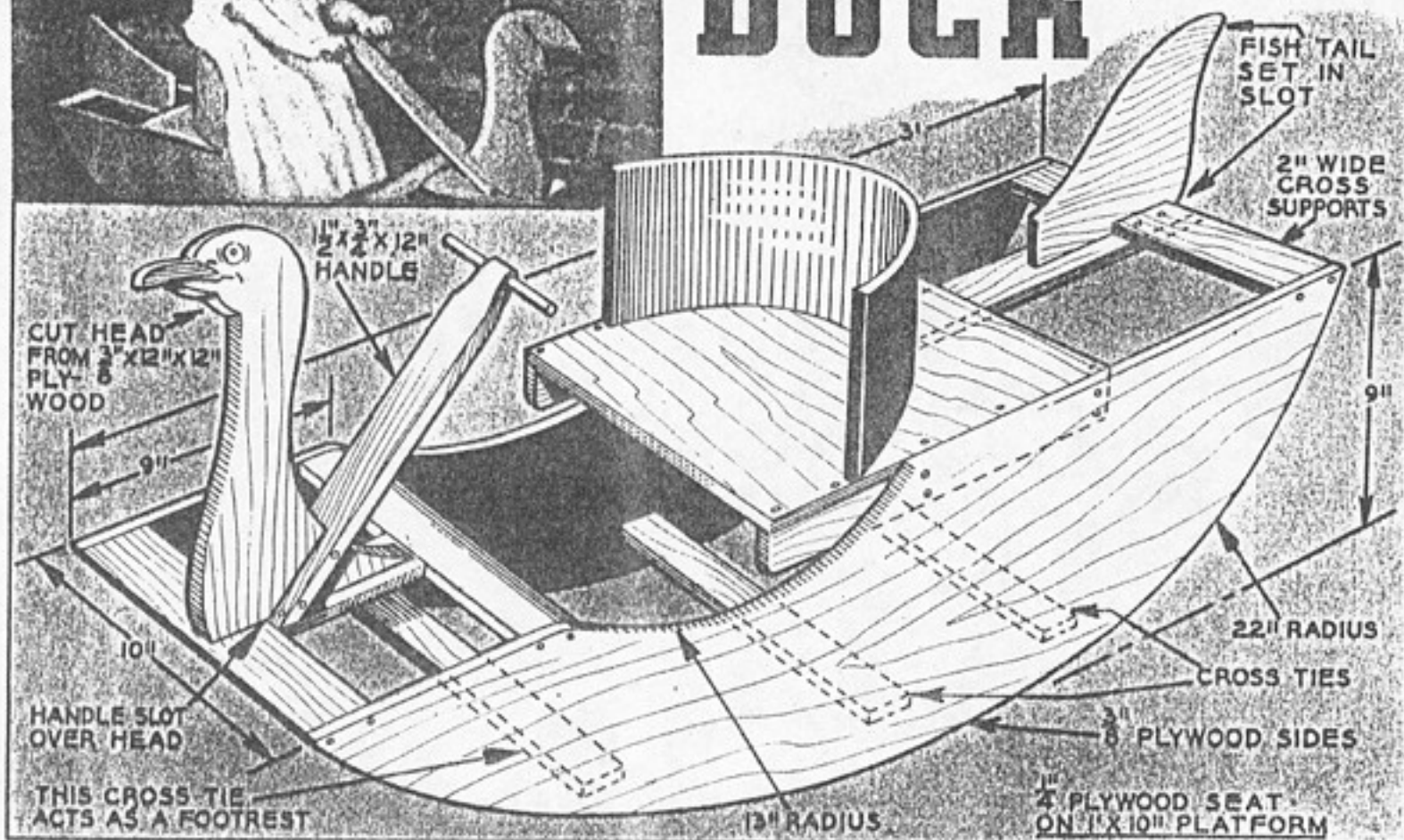


Modern Mechanix MAY, 1939

the ground. The four boundary lines of the court consist of cotton strips, torn from rags and stitched together. Peg the boundary strips to the sod. The game is played using Badminton rules.—G. E. Van Horn.



ROCKING DUCK



MODERN MECHANIX MAY, 1939

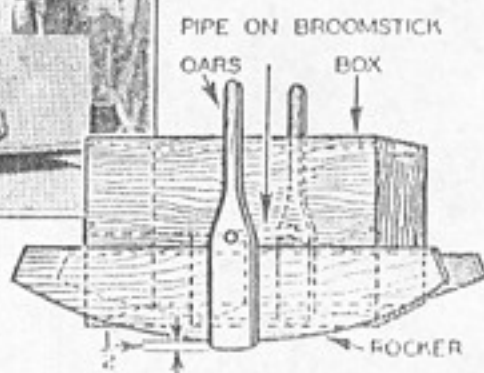
THIS sturdy, practical toy may be easily built from plywood and scraps. The drawing above gives all necessary instructions and dimensions for building it. Cut out the sides, head and tail with a coping saw.

If the curved seat back presents any difficulty, a simple straight one may be substituted. To make a lasting job the duck should be screw fastened throughout. Finish by enameling in bright colors.—C. Ibberson.

Amusing Rocker Toy for Children Made From Box and Scraps of Wood



HOURS of amusement will be afforded children by the hand-operated rocker shown at the left. It is constructed from a wooden box, large enough to accommodate a youthful occupant comfortably, to whose sides are nailed wooden rockers cut from pieces of hardwood. Then add the paddle-like handles, which swing on a broomstick or pipe axle. A crude but entertaining form of locomotion results from rocking and manipulating the handles.—D. H. Butler.





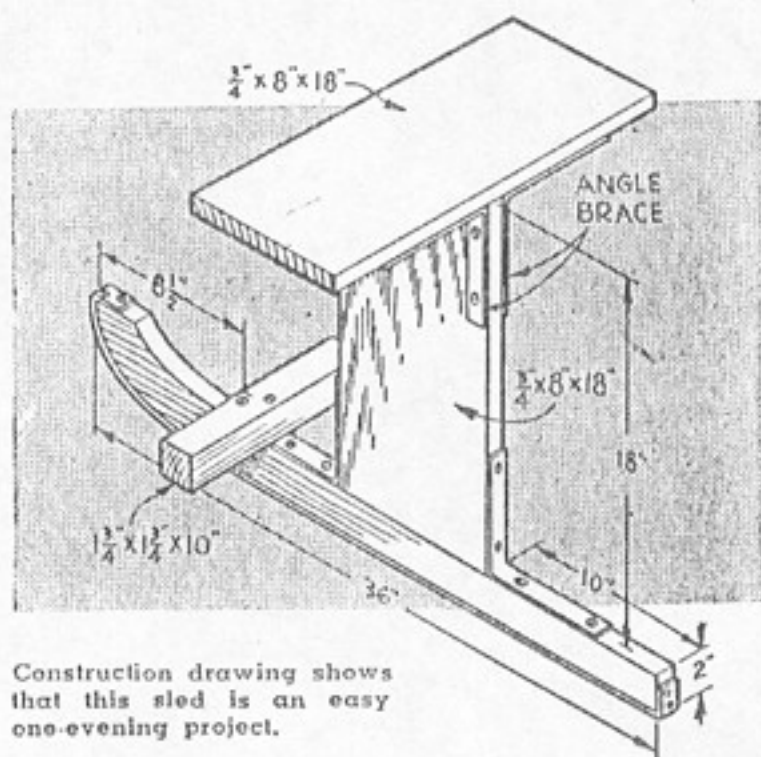
By NORBERT ENGELS

FOR some undiscovered reason, people around Canonsburg, Pa., call this sled a Yankee. They claim it is a real thrill to coast down a slippery hill on its single runner. It is easy to make. Cut out a runner of hard pine, maple, or birch. It should be about 36" long, including the curve at the front end. The upright is a plain board, about $\frac{3}{4}$ " x 8" x 18 inches, and the seat is the same size as the upright. A cross bar about $1\frac{3}{4}$ " x $1\frac{3}{4}$ " x 10 inches is provided. Six 6-inch angle irons and a metal strip for a runner complete the requirements for materials for this project.

Making the Fastenings

SCIENCE AND MECHANICS
DECEMBER, 1947

Fasten the upright to the runner with angle irons about 10 inches from the back end. Fasten the cross bar about 8 inches from the front end and place the seat in position, securing it with



angle irons, two in front and two in back. Screw the metal runner into position and give the whole works a couple of coats of good water-proof varnish, or color it up with enamel.

All finished? Then put it under the Christmas tree and watch the youngster's face when he tries it out. He'll get a lot of thrills out of it all winter long.

Angel tree

JAMES A. LAWRENCE



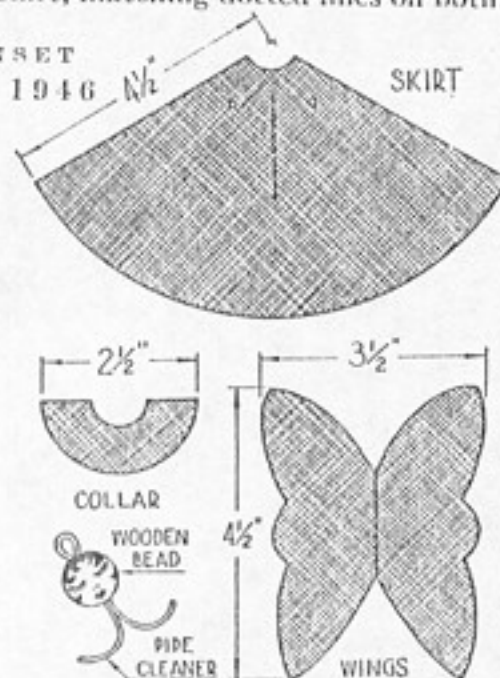
DIRECTIONS FOR making angels with frothy wings and stiff skirts were given to us by Mrs. Joseph Canet of Mill Valley, California. The angels may be used as tree ornaments, or suspended on an angel tree.

Force a silver-painted branch onto a needle holder anchored to dish with modeling clay. Hang angels on tree.



Cut and mark a paper pattern following diagram below. Using pattern, cut the angel's skirt and collar from buckram; decorate with cut-outs from colored paper doilies. The wings may be cut from a single thickness of buckram or several thicknesses of crinoline. Machine stitch the angel's wings to skirt, matching dotted lines on both.

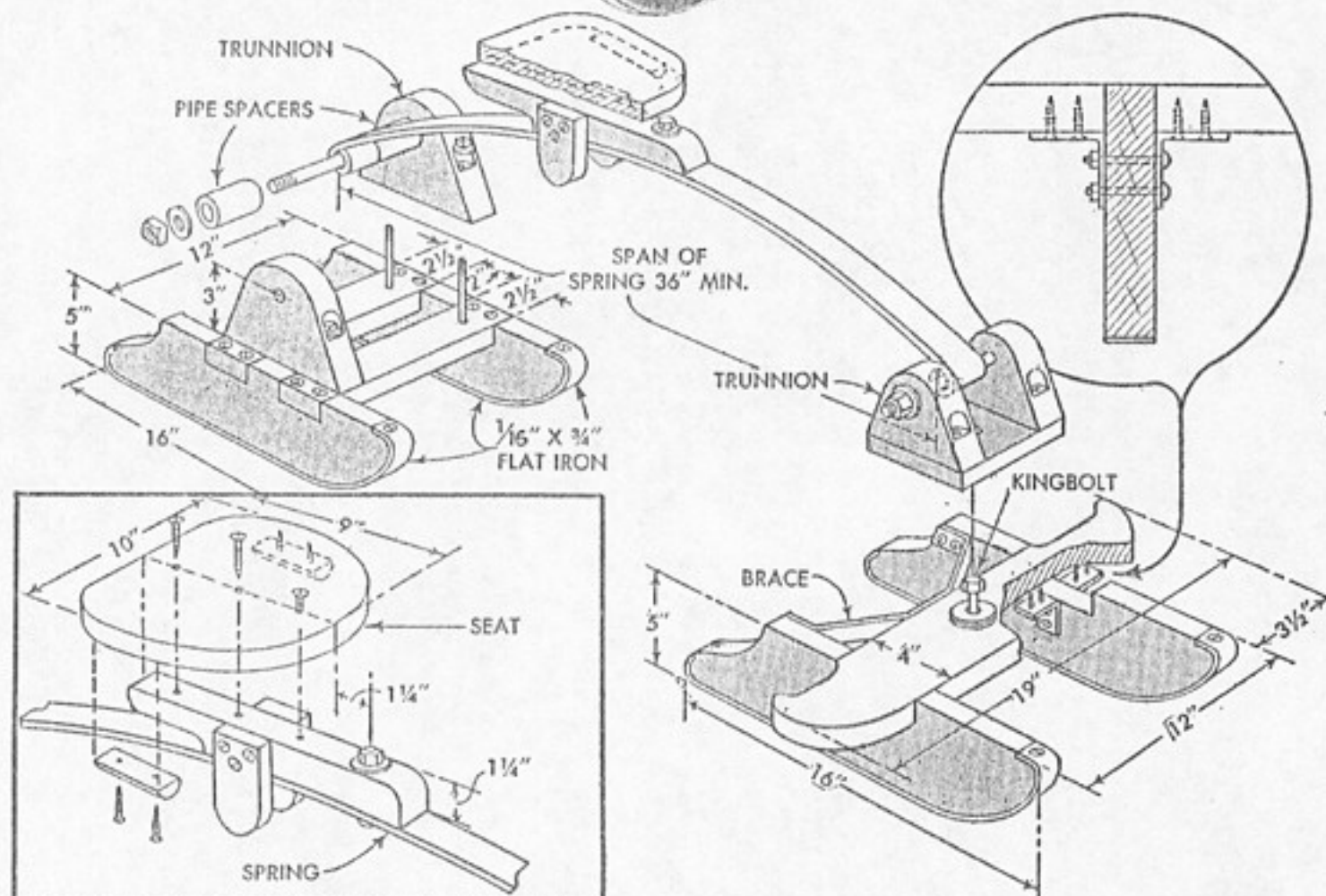
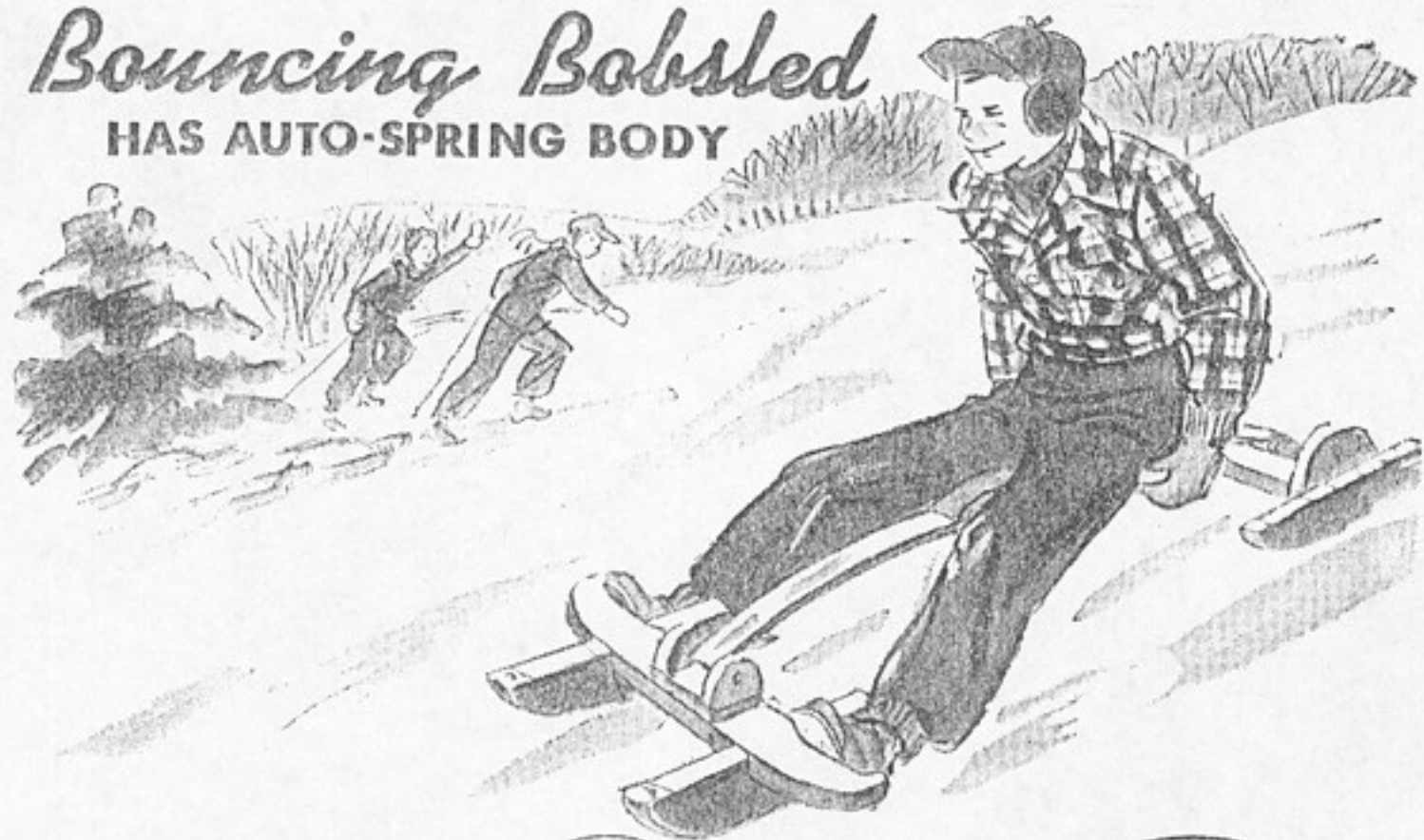
SUNSET
DECEMBER 1946



Paint angel's features on a round wooden bead. Push a pipe cleaner through the bead as shown. Force the pipe cleaner through the holes in the skirt and bend together underneath. With needle and thread, fasten collar around neck and sew edges of skirt.

Bouncing Bobbled

HAS AUTO-SPRING BODY



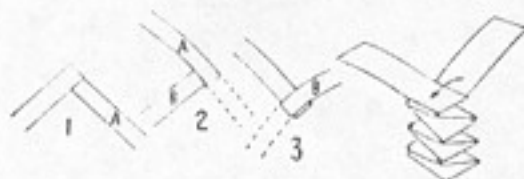
THE bumpier the slide the better with this spring-bodied bobsled, which is steered with the feet so that the rider can hold on to the seat. The main leaf of an auto spring is held by lengths of iron rod set through wooden trunnions, which are bolted to cross members screwed to sled runners shod with strips of flat iron. Since the rear trunnions are widely spaced to prevent the sled from upsetting, the spring is centered on the rear rod by pieces of pipe. On the more closely spaced front

trunnions these are not needed, although washers may be used between the spring and trunnion sides. Corner irons reinforce the foot rest. The seat is screwed to a support that is attached by a kingbolt through the hole in the spring. Wooden guides screwed to the support prevent side sway of the seat, and narrow cleats are attached to the underside of the seat for finger grips. Spring and runner irons are painted to prevent rusting, and the wooden parts are shellacked and varnished.

Christmas ornaments with scissors and paper

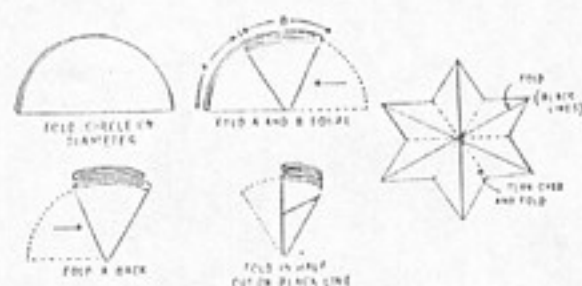
SUNSET NOVEMBER 1944

ALL THE Christmas tree ornaments shown on these pages are based on fundamental paper tricks which you can master easily—you probably learned them in kindergarten! The first is the six-pointed star. Fold a circle of paper in half to make a semi-circle; fold the semi-circle in thirds and then in sixths, as shown in the illustration. Cut the folded twelve thicknesses of paper at an angle.



Silvery ball ornaments left over from other Christmases might be used in these decorations, but it's just as satisfactory to buy kindergarten beads and gild or silver them. Heavy cotton thread is used to attach the various parts of the ornaments together and to make loops with which to hang them on the Christmas tree.

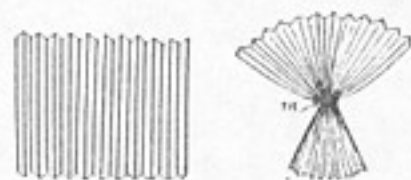
Construction paper, which may be purchased by the package at stationery shops, will make any or all of the ornaments.



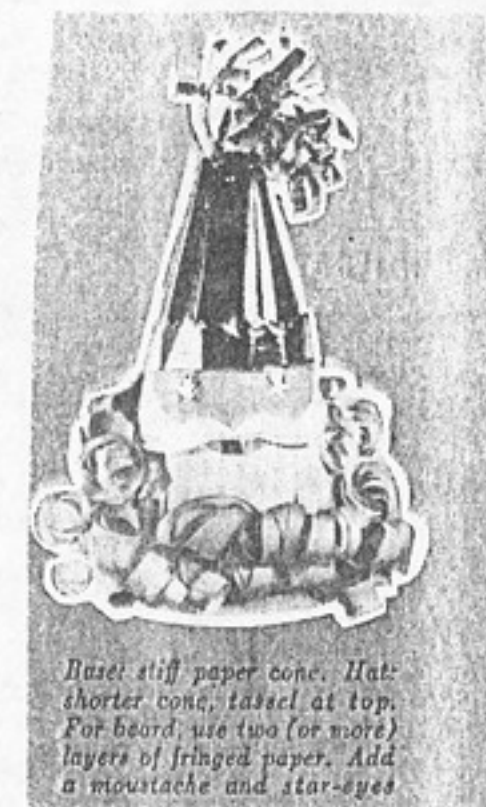
Spread out the star and fold again so that the center protrudes slightly. An ornament using the finished star is shown at right; you can make many more.

The cone, base for the Santa Claus and the bells, is made with a quarter circle of stiff paper. It may be glued, stapled, or taped together. Fringes should be cut from lighter weight paper if they are to be curled, like Santa's beard and the angels' hair. To curl, "fringe" paper and draw blade of scissors across each strip. If the fringe is to be heavier, as in the stamens of the "fuchsia" or the clappers of the bells, it may be cut of heavy paper.

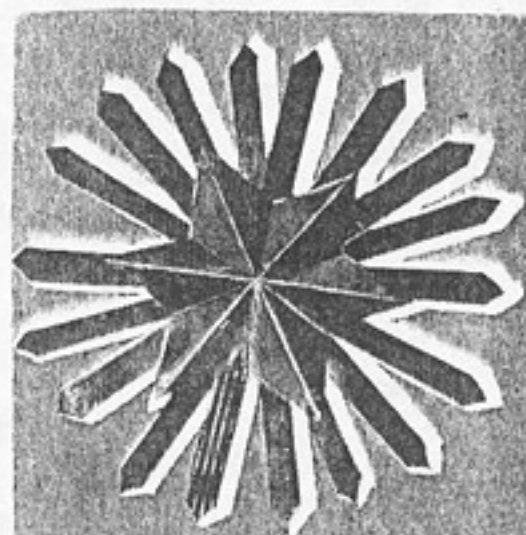
The fluted fans are sheets of paper pleated, as shown, and fastened in the center. This is used for the angel's halo, both angels' ruffs, and the bauble in the lower right-hand corner. When the pleats are to be made into complete circles, the corners should be fastened together with heavy thread or with paste.



"Cat steps" are made with two strips of paper exactly the same width, folded together. Start by putting the ends together, at right angles; then fold the strips over each other alternately. The resultant chain is used for the bells (see below) and to encircle the tinsel ball on the star at right.



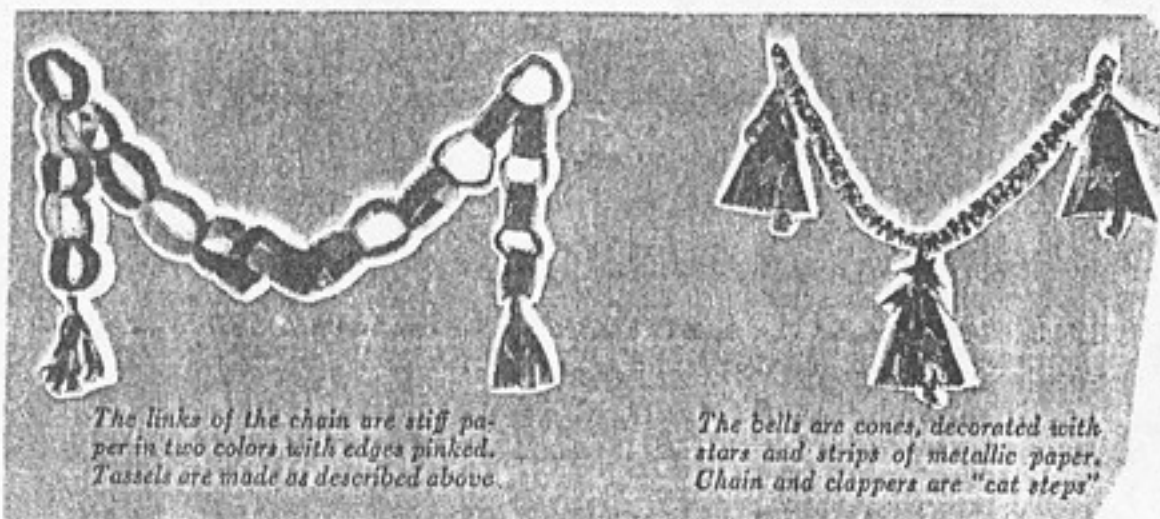
Base: stiff paper cone. Hat: shorter cone, tassel at top. For beard, use two (or more) layers of fringed paper. Add a moustache and star-eyes.



Pointed strips of stiff paper are glued to circle (behind star). The star is folded to give extra depth.

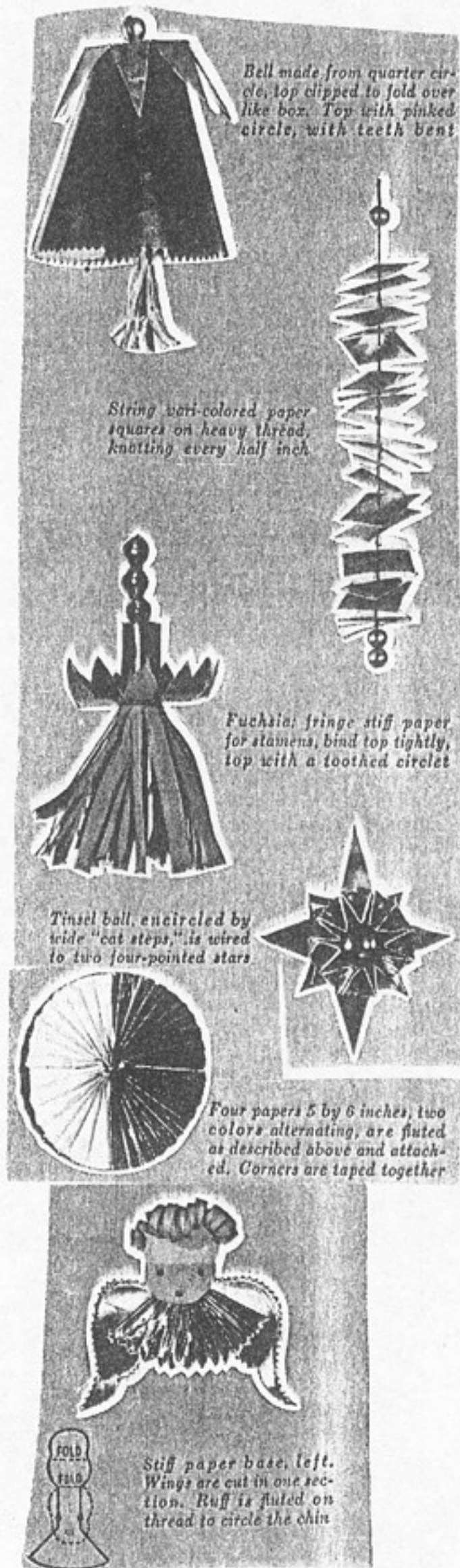


Halo is cut as shown at left. Head is cut in one piece with body. Features are dots of ink or paint.



The links of the chain are stiff paper in two colors with edges pinked. Tassels are made as described above.

The bells are cones, decorated with stars and strips of metallic paper. Chain and clappers are "cat steps".

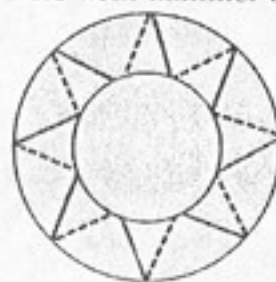


These shapes were cut from patterns below

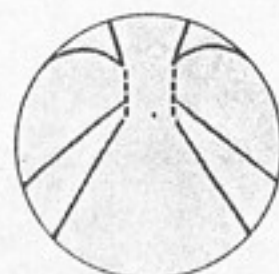
Bright ornaments from metal lids

In just a matter of minutes you can turn an ordinary tin can lid into an attractive Christmas tree ornament (see page 68). You may want to draw your design on the lid with a pencil or crayon first. Using kitchen shears or tin snips, cut the lid to your design. Fold as desired, being careful of sharp edges. Apply acrylic paint.

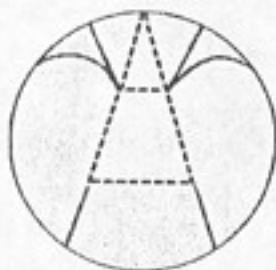
For finishing touches, you could use yarn, gold notary seals (sold by most stationers), sequins. To hang each lid, punch a hole with hammer and nail; attach string.



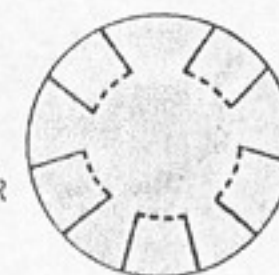
STAR



ANGEL



SUNSET



FLOWER

DECEMBER 1967

Solid lines for cuts; broken lines, folds

A stableful of Christmas ponies

SUNSET DECEMBER 1964

Few toys come with such a sound guarantee of fun as hobbyhorses. This fact goes far to account for their ancient lineage and the great diversity of their design.



Old-fashioned stick horse will please a small child for a long time. You may remember one like this from your youth

The three horses on this and the following pages bear out this diversity: They range from a simple stick horse to a spring-driven thoroughbred that takes a 50 to 90-pound youngster to master it.

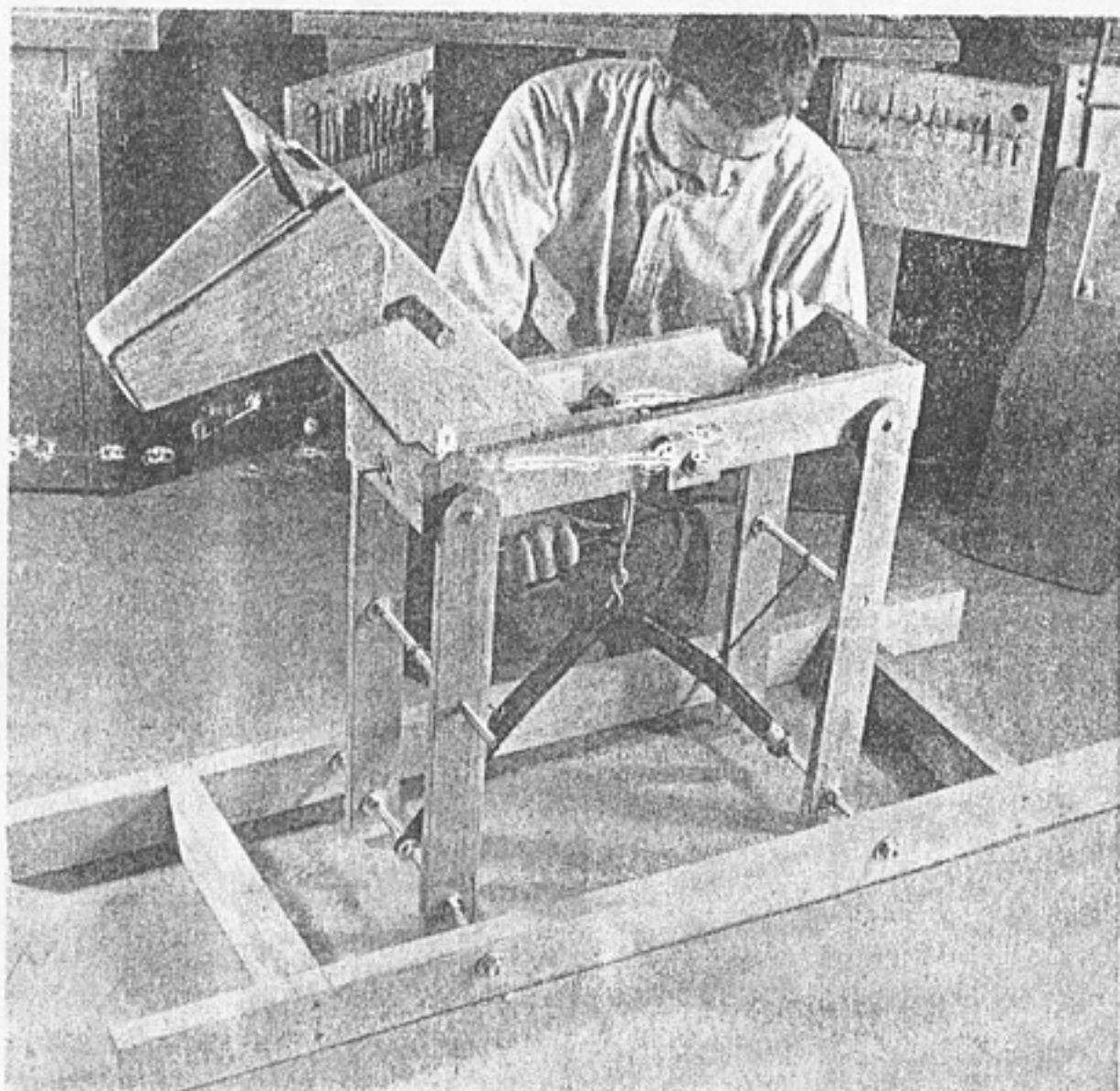
A TRADITIONAL STICK HORSE

To make the horse pictured above, stuff the foot of a heavy sock solidly with cotton. Cut rounded triangles of felt for ears and sew in place. Sew on button eyes and stitch a mouth with embroidery thread. Cut a quantity of 4-inch lengths of yarn for forelock and mane, and stitch them through the middle down the neck.

Fashion the bridle from leather strips (or rawhide laces), allowing enough extra for the reins. Cut a broomstick to suitable length, work the cut end well up the neck, and pack cotton around it firmly. Tuck the top of the sock under and gather the end tightly around the stick with strong thread. Secure the head by driving upholstery tacks through the end of the sock into the stick.

A HORSE ON A SPRING

All hardware for this horse is available at a well stocked hardware store. Cut the legs and round the tops. Drill a 1/4-inch



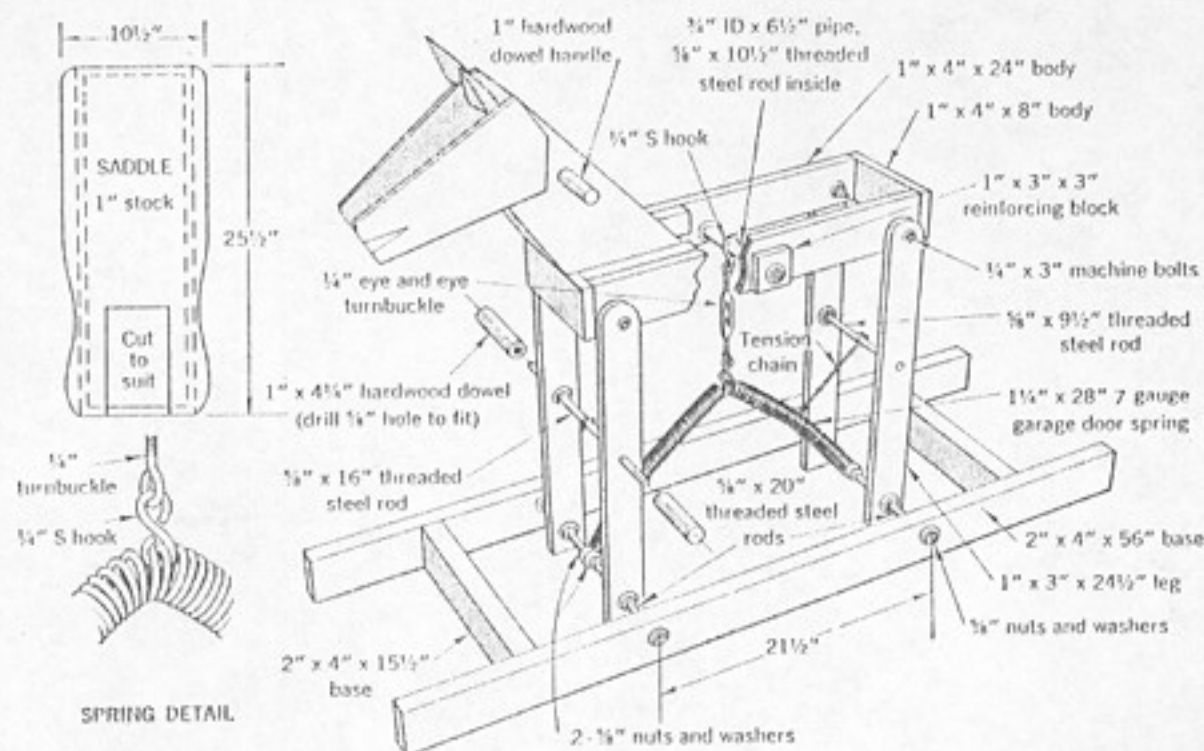
Before Christmas

This horse's muscle power comes from a garage door spring. Tightening turnbuckle makes for stiffer action



After Christmas

A bronco after a child's dream. Horse describes a galloping arc but always stays horizontally level



You'll need about 8 1/2 feet of 1 by 3-inch finished hardwood for the legs, 5 1/2 feet of 1 by 3 finished clear fir for the body, and 12 feet of 2 by 4 for the base

hole in each leg equidistant from sides and top, a 5/8-inch hole 22 inches below it (about 1 1/2 inches from the bottom), and a 5/8-inch hole halfway between.

Cut the body pieces and drill 1/4-inch holes in the side pieces where the legs will join them. Glue on the reinforcing blocks and drill a 5/8-inch hole through each. Assemble the body with white glue and nails; run the rod through the pipe, and secure it with nuts and washers.

Bolt legs to the body, using 1 1/2-inch-diameter washers between legs and body.

Assemble the base with white glue and nails, and drill 5/8-inch holes in the side pieces to receive the lower rods.

Assemble the spring mechanism by bending the spring in half sharply, to force the coils apart in the middle. Holding the spring in a bent position, have a helper slip an S hook under two coils (see detail). Crimp hook closed around coils. Run lower rods through base, legs, and spring, threading on nuts and washers as you go. Leave nuts loose for the time being. Attach rods midway up the legs with nuts and washers on the inside only, and glue the drilled dowels over the protruding ends of the front rod.

Attach an S hook to the pipe, then insert both hooks in the turnbuckle eyes and crimp closed. Tighten the turnbuckle to hold the horse upright. Attach the two chains (they keep the spring from binding when the horse rocks) by bolting around the bar at one end and running a small wire under a coil of the spring and through a link of the chain at the other. Tighten all nuts except those flanking the 2 by 4's

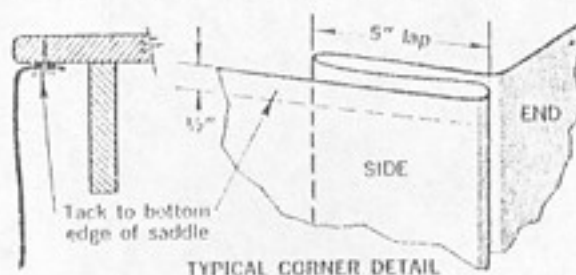
and the spring. Leave these slightly loose so the rods can move with the legs. Lock all nuts in place by dabbing a little white glue on the threads.

Use scrap lumber to build the head and neck to whatever design you wish. Ours is attached to the body with wood blocks, glue, and nails. Cut the saddle board to fit around the neck. This board extends out far enough from the sides to permit the skirt, which hangs from it, to clear the hardware below. Four screws, countersunk, secure saddle to frame.

The horse's skirt serves to cover the moving parts at top and to fill out the body to horselike proportions. Make it from a 15-inch by 10-foot strip of 8-ounce duck. Baste in the pleats along the top (see sketch) and tack the skirt along the underside of the saddle with upholstery tacks, starting at the back and following the saddle's edge as you work forward to the neck opening. At that point, screw down the saddle and tack the rest of the material to the front of the body. You'll have enough material left for an overlap in front.

The tail is a length of untwisted rope.

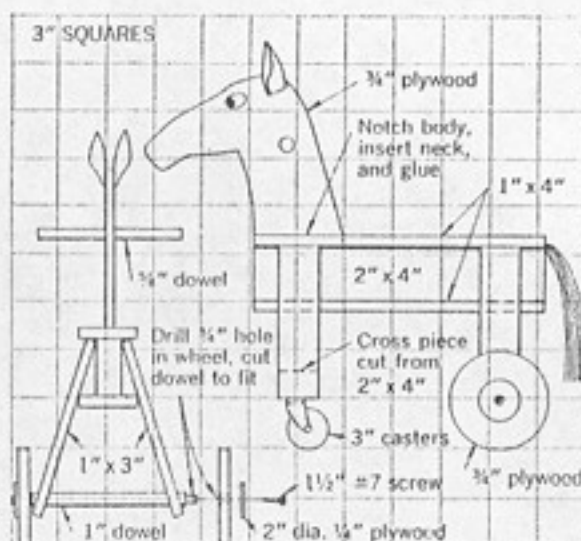
If the weight of your youngster rocks the horse too far, so that it swings down



Four pleats let skirt expand as legs move



Benign-looking critter can be walked along, bounced on, but is shifty enough to buck if child puts weight far forward



Grid shows sizes for hobby horse members

to the base and stays there, limit the arc by drilling a 1/4-inch hole in front and back body pieces, attaching two 1/4-inch eyebolts, eyes inside, and running a loop of stout clothesline from each eyebolt to the rod midway up the leg on the opposite side. Adjust the length of the line to stop the horse before it reaches the collapsing point.

A HORSE ON WHEELS

A sturdy sawhorse is the frame for this pony. Front wheels are large casters for maneuverability, rear wheels are 3/4-inch plywood disks that rotate on a 1-inch dowel axle fixed in holes drilled at an angle through the legs. Small 1/4-inch plywood disks glued and screwed to the dowel ends hold the wheels on. The cars are leather triangles, glued and nailed to the 3/4-inch plywood head. The tail is rope, glued and nailed into a 1/2-inch slot in the upright 2 by 4. All members are attached with white glue and nails. See the diagram above for details.



SUNSET
OCTOBER, 1976

One good whack of her palm flattens glob of dough before she gets down to serious sculpting

The punchy spell of play dough

Each generation of children seems to fall under the spell of play dough. Punching the soft, squishy dough can be mesmerizing—and maybe unleashes a little youthful aggression at the same time.

Of the many play dough recipes we tested, this one proved the best. It holds together longer and is cleaner to work with. One batch, enough for three or four children to play with, costs about 25 cents. The dough can be used right away, or leave it in the refrigerator for up to 10 days.

Play Dough

- 2 cups all-purpose flour
- 1 cup salt
- Food coloring (optional)
- 1 cup water

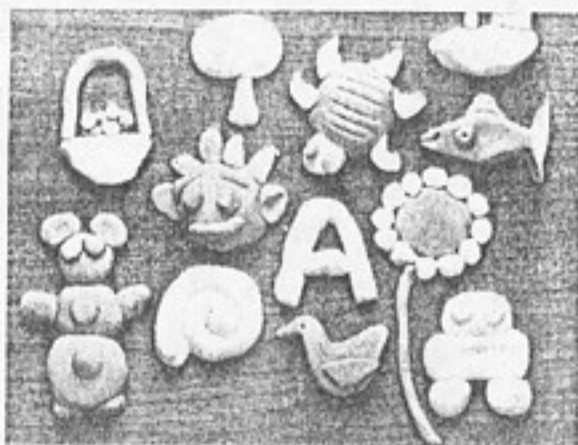
Mix the flour and salt together in a bowl. Add food coloring and water (a little at a time) until you have a ball of dough. Knead thoroughly for 5 to 10 minutes or until dough has a firm, smooth consistency.

If you plan to use it later, enclose the dough ball tightly in clear plastic wrap. When you take it from the refrigerator, you can use it directly; if it has dried out, pat on a little water and knead back to a

smooth consistency. If dough becomes sticky, add some flour and knead.

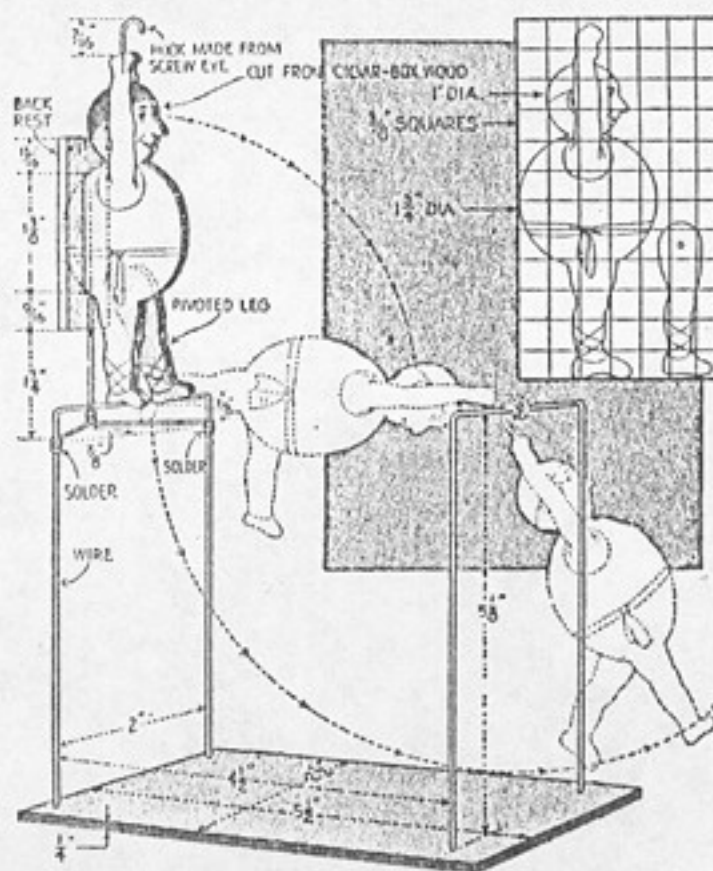
Kitchen tools can add dimension to the children's sculpture. A few suggestions: forks, pizza cutter, melon-ball shaper, toothpicks, garlic press (for hair and beards), and measuring spoons.

If you want to save a piece of sculpture, let it air-dry on a rack until hard throughout (about 48 hours). You can then leave the finish as is or paint it with watercolors, acrylics, or other paints. If you wish, top it off with a glossy sealer such as shellac or clear polyurethane. □



Fanciful shapes from homemade dough include flora, fauna, clown, and letter

This Tumbling-Acrobat Toy Will Delight Small Children



Dropping from a vertical position on one bar, the acrobat grabs the second bar as he falls and swings safely in a realistic manner

Here's a simple toy that will give the children a lot of fun. When the acrobat is knocked over, it appears to be falling to the floor. But just at the crucial moment, it hooks onto the next bar and swings with ease. A slotted back rest keeps the acrobat in position for the next act. The figure is cut out of cigar-box wood with the arm and the right leg in one piece. The left leg is cut separately and swings on a pivot to give movement. A couple of pencil lines will establish identity of the arms and both sides.

Writing On Egg Whites

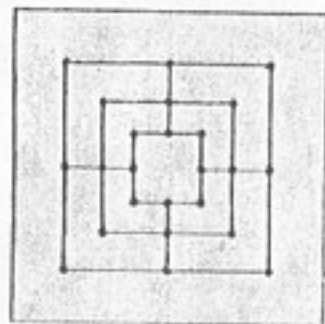
Have you ever broken open a hard-boiled egg to find your name carefully written on the smooth surface of the white? Impossible as it seems, it is really easy to do. Using half an ounce of alum dissolved in half a glass of vinegar as your "ink," write the name or message which is to appear inside, on the unbroken shell. A small water color brush or toothpick wound with cotton will make a good pen. Boil the egg ten or fifteen minutes. The shell will then show no trace of lettering, but the writing will appear clearly on the hard-boiled white.—George E. Deering,

How about a game?

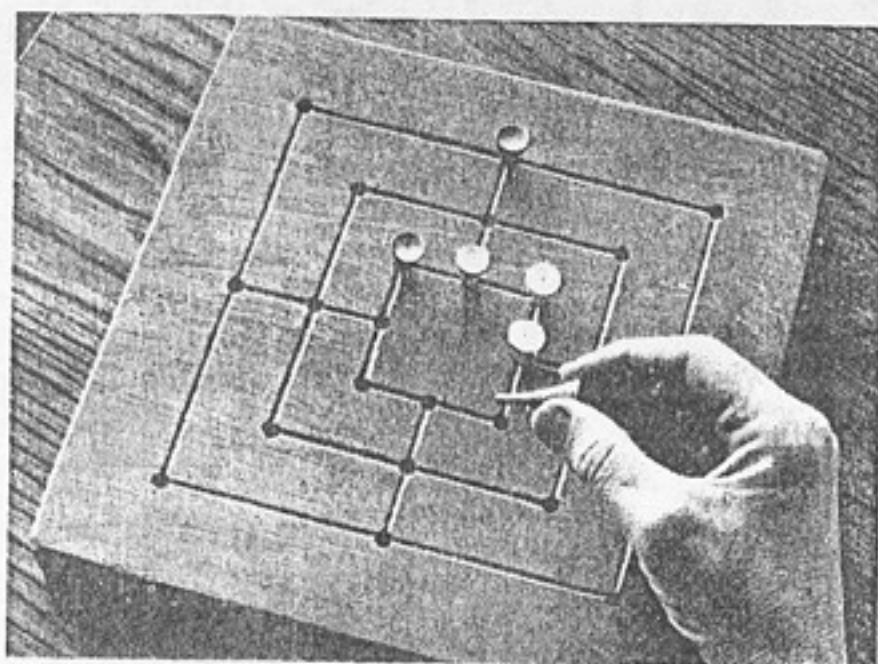
In strategy this game can be as complicated as an adult wants to make it. Yet it's simple enough to amuse children.

We learned it from John R. Johnson, of Menlo Park, California, who says it has been a family favorite for about 30 years. He has made so many boards for friends, some now call the game "Johnson."

The rules? The object of the game is to get your three men lined up along any one of the lines before your opponent can do so. In your first three turns, each of you places a man on the board—anywhere you desire. Thereafter you can move only to an adjacent hole, and only along a line. You are not allowed to jump over a man, and you can't move between holes not connected by a line.



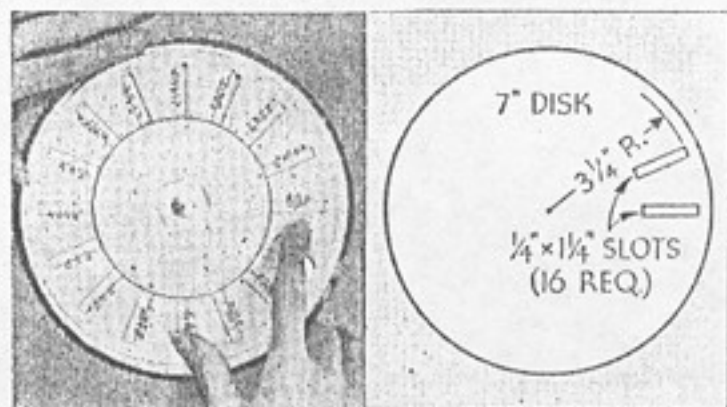
This board is made of $\frac{3}{4}$ -inch plywood 8 inches square (it can be any size) with 21 holes of $\frac{3}{16}$ -inch diameter drilled $\frac{1}{2}$ inch deep. Lines are painted or routed



Strategy game

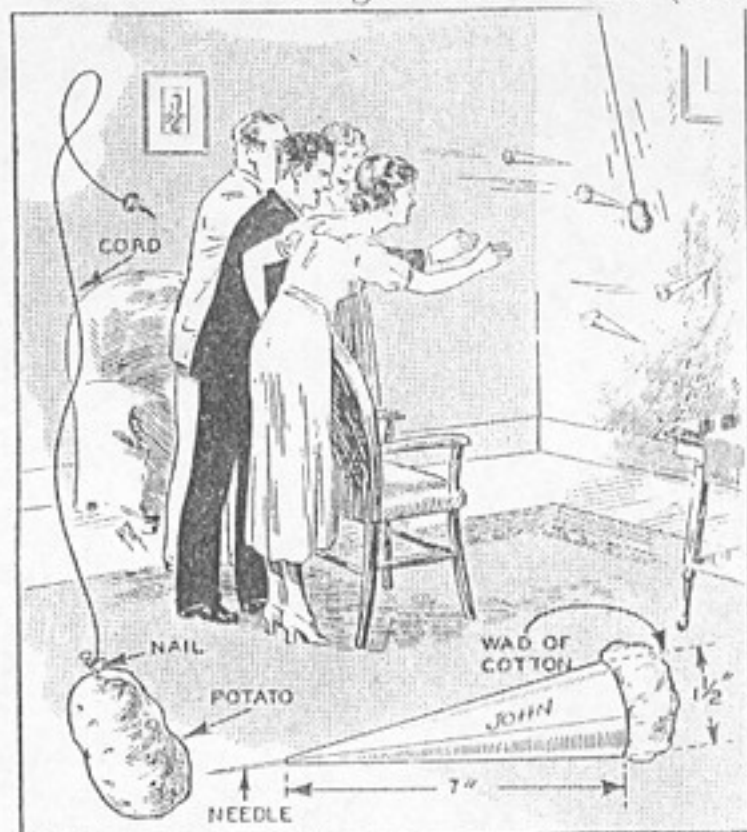
Johnson's game is kind of a cross between checkers and tick-tack-toe; the board is plywood with holes drilled and lines marked, the six "men" are golf tees with pointed tips sawed off

Find-the-Word Game Is Fun



CHILDREN learning to read will like (and

be helped by) this simple toy. Part of a word is lettered on the slotted upper disk and part on the lower disk. By turning the upper one, the letters of one word at a time can be made to match. Cut 16 slots in one cardboard disk. Place this over the other and mount both on a base with a thumbtack. Letter the words near the edge of the slots so half of the word is on each disk. Turn the upper disk between the lettering of each word. Then only one word at a time can be matched—R. J. De Cristoforo, Manhattan, N. Y.



Here are the details for the "spike the potato" game. It requires real skill and was designed for party use.

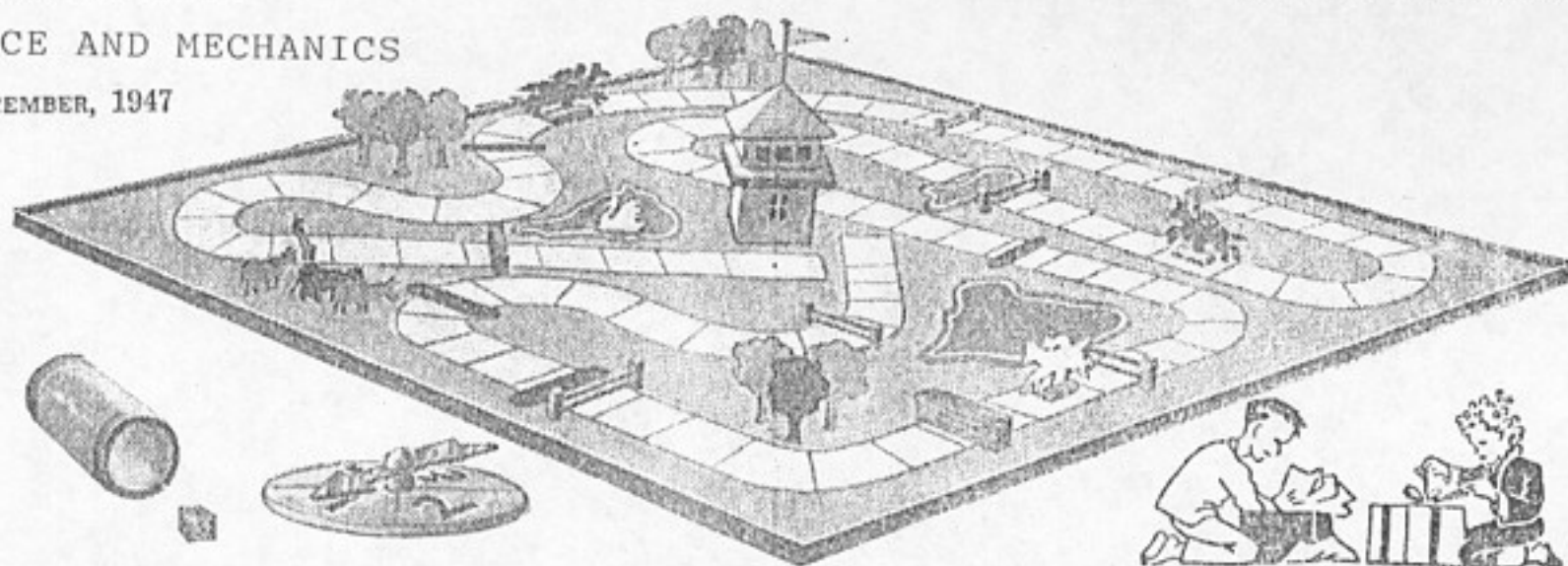
Unique Game for Party Amusement

"SPIKE the Potato" is a highly entertaining game for any party. All that is needed is a single large potato, a number of paper cones and some needles. The paper cones are about 7 in. long and $1\frac{1}{2}$ in diameter at the large end. When you roll them into shape, slip a needle or pin into the small end and daub it with glue. This, when dry, will hold it in place. At the same time, glue the edge of the paper fast. Then pull a small tuft of cotton into a fluffy ball and after rubbing some glue on the inside of the open cone end, push the cotton in.

The game is played in this fashion: Suspend the potato near a wall and arrange a row of chairs six feet away. No contestant may approach nearer than the backs of these chairs. Ask the people to get ready and then step up and swing the tuber. As soon as it swings, the signal may be given for firing. Guests should throw their cones in an attempt to stick them into the potato, as demonstrated in an accompanying photo.

SCIENCE AND MECHANICS

DECEMBER, 1947



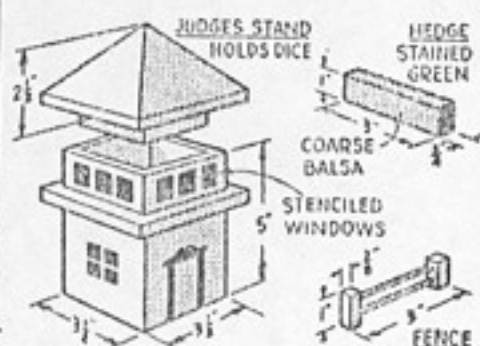
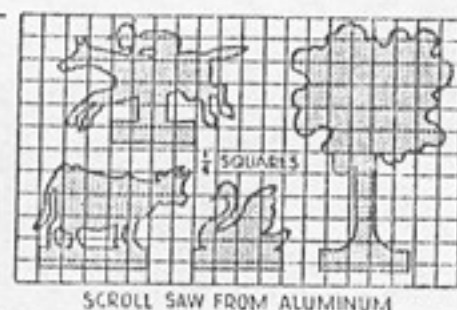
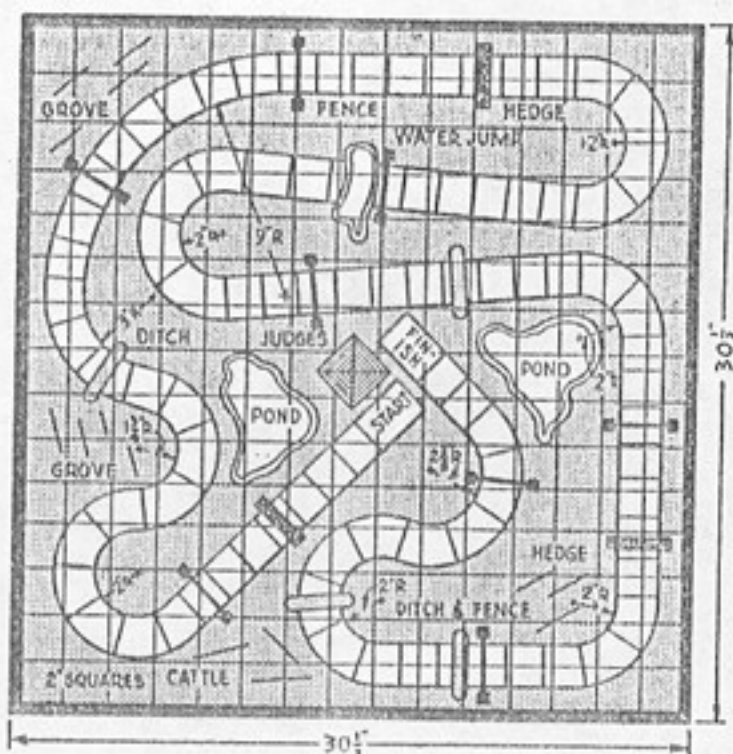
STEEPLECHASE GAME

By HI SIBLEY

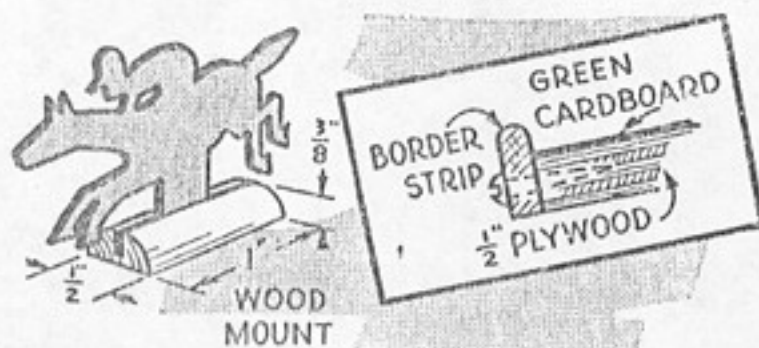
THE term *Steeplechase* originated years ago in England when cross-country race courses were plotted by church spires. In this game you'll have a lot of fun in the confines of a card table, the board being made that size.

As many as four players can be accommodated on the course, starting side by side with the little duralumin horses. Either a spinner or one dice may be used, the player moving ahead as many spaces on the track as indicated by spin or throw. His progress is interrupted only when he stops at a fence, ditch, hedge or water jump. If at a fence or hedge, he loses one turn, the ditch two turns and failing to pass the water jump puts him out of the race permanently. Start and finish are at the judge's stand, which serves as a holder for the dice box when the game is stored away or not in actual use.

Make the board of $\frac{1}{2}$ inch plywood, with a $\frac{1}{4}$ inch hardwood border mitered at the corners and secured with $\frac{3}{4}$ inch oval-head screws. Glue green cardboard or illustration board to the plywood, the course having been cut out of yellow paper and pasted on, the ponds in blue and the entire surface shellacked. Horses, trees and animals are scroll-sawed from duralumin and mounted as shown and appropriately painted. Fence and judge's stand are in white, the latter with a red roof, and hedges green. Ditches are



brown paper pasted across the course. All the items such as trees, fences, judges stand, hedges, and all the animals except the horses should be



secured to the board with brads and glue.

That completes the construction of the game. It should provide many hours of pleasure for the youngsters the year 'round.

Small depressions in the sand were the original "boards" for both these two-man games, which come from opposite sides of the earth.

The rectangular board at right is for the game called *Kalaha*. There's evidence that it was played in the Kalahari desert in South Africa as long as 7,000 years ago. The configuration of pits has been found carved in stone along caravan trails in many regions of Africa, Asia, and southern Europe.

The game below, *Konane*, was being played in Hawaii when the first Western explorers arrived.

You can make both game boards from any kind of wood, cutting out the depressions with a core bit in a power router, or with a gouge.

Kalaha, from Africa

The board. Make a row of six 2-inch-diameter pits on each side of a 20 by 7½-inch board and two elongated pits between these rows at the ends of the board. The pits are ½ inch deep. Use 36 small wooden beads from a hobby shop as "seeds" to "sow" in the holes.

The game. Each player starts with three beads in each of the six holes in front of him. The goal of each player is to put as many beads as possible in the elongated Kalaha hole at his right.

The first player picks up all the beads in any one hole on his side and "sows" them: He puts one in each hole around the board to the right until he runs out of beads—including one in his Kalaha



Kalaha player is about to capture the seven beads in the hole across from him. He'll put them, along with the captor bead (in his hand) into elongated hole on his right. Game board is made from teak slab

SUNSET

MARCH 1973

Games from Africa (beads in 14 pits) and Hawaii (pebbles in 64 pukas)

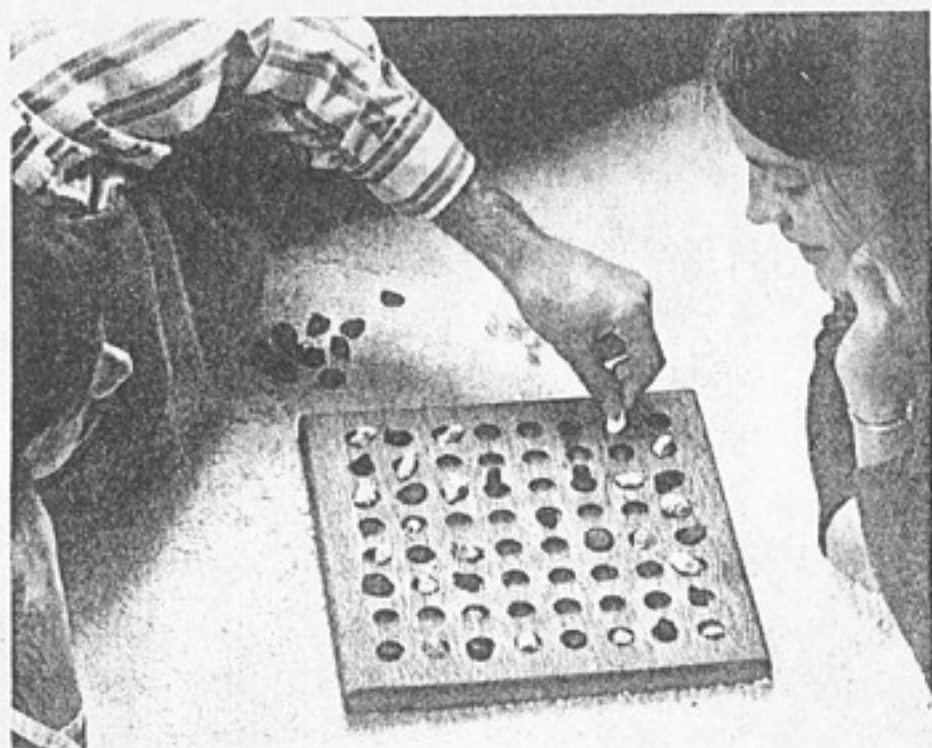
and one in each of his opponent's holes, but not in his opponent's Kalaha.

If the last bead sown lands in his own Kalaha, the player gets another turn.

If the last bead lands in an empty hole on his own side, the player captures all the beads opposite that hole and puts them in his Kalaha along with the capturing bead.

The game is over when all six holes on one side are empty; all the beads left in the holes on the other side go into the Kalaha of the first man out.

The winner is the player with the most beads in his Kalaha.



Light-colored pebble used in Konane is jumping a dark one to remove it from play. Pieces move by jumping opponent's pieces until one player can no longer jump; he loses. Game board is mahogany

Konane, from Hawaii

The board (called the "papamu"). It's traditionally made from native Hawaiian koa wood carved with 64 "pukas" or holes. The one on page 133 is 11½ inches square with ¾-inch-wide pits drilled on 1¼-inch centers. The dark playing pieces (traditionally bits of black volcanic rock) are *ele*; the light pieces (coral) are *kea*. Again you could use beads or pebbles—32 for each team.

The game. You set up the board by filling the holes alternately with dark and light pieces until all holes are filled. The object of the game is to maneuver your opponent to where he cannot jump any of your pieces on his next turn.

To begin, one player selects a piece of each color from the board and, with his hands behind his back, conceals a piece

in each hand. He then presents both hands with the pieces concealed and his opponent touches one hand to select the color of his team. The dark team always plays first. The two pieces used in selecting sides are returned to the board.

The first player has two alternatives: He can remove one of his two dark pieces at the center of the board or one from a corner of the board. His opponent then removes one of the light pieces adjacent to the empty space. These two pieces are out of the game, and play begins.

With two empty spaces on the board, the dark player jumps one of his opponent's pieces and removes it. All moves after this point are made by jumping one or more of the opponent's team.

Jumping must always be in a horizontal or vertical direction, not diagonally, and

not in more than one direction in a single turn. A player may jump as many of his opponent's pieces in a single play as he desires, provided he lands in an empty space. And as in checkers, the jumps must be made in leapfrog fashion over pieces staggered at one-space intervals.

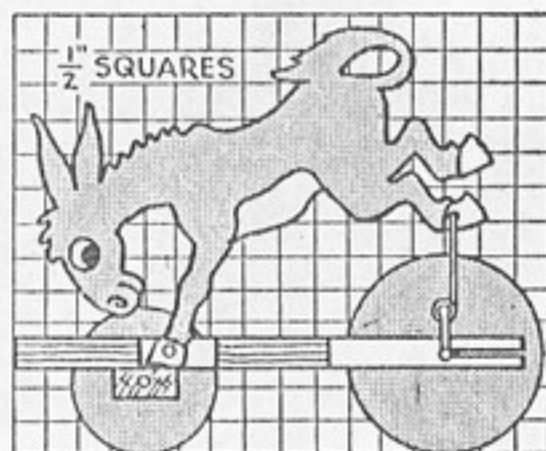
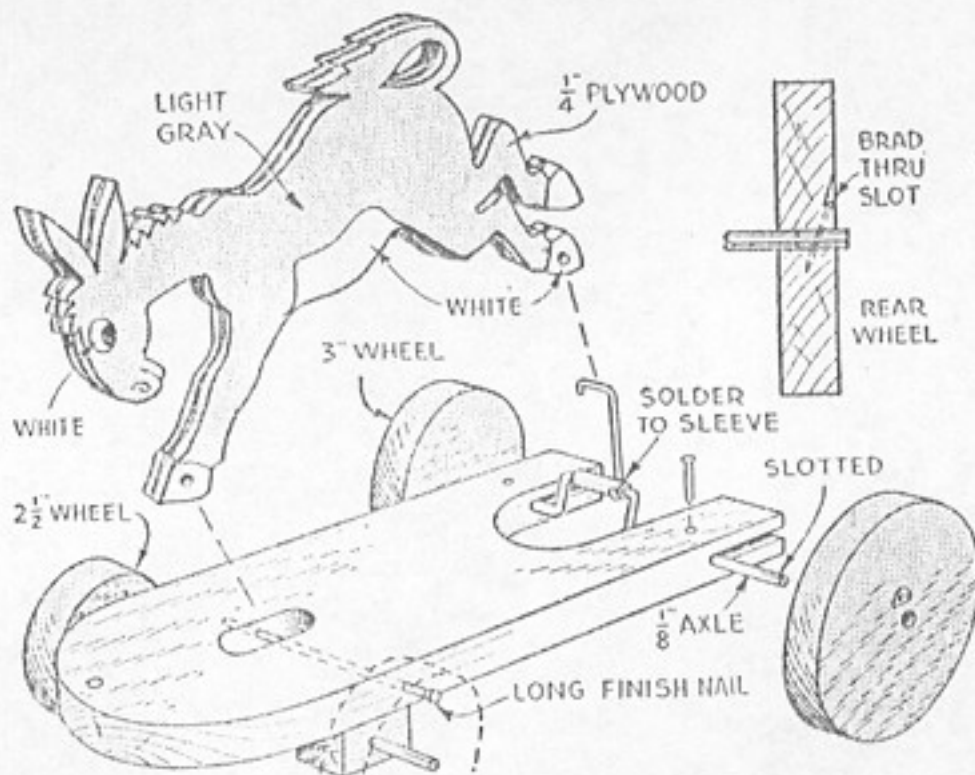
A player may elect not to take all the jumps available to him in a single play. He must make at least one jump, but can decline to move farther if he feels it's to his advantage.

As the game progresses, there are fewer and fewer pieces on the board, thus fewer chances to jump an opponent. When a player can no longer jump an opposing piece, the game is ended, and that player is the loser. □

SCIENCE AND MECHANICS DECEMBER, 1948

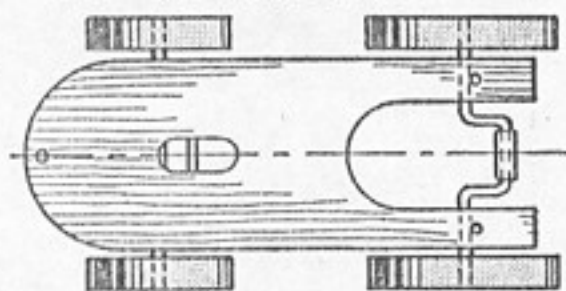
KICKING MULE

WHEN drawn across the floor this ornery critter kicks up his heels in a convincing manner and should amuse a child until it wears out. Scroll-saw the mule from quarter-inch plywood and paint light gray with a white belly, eyes, and hoofs. For the actuating mechanism bend a ⅛ in. rod into a crank after putting on a short sleeve. Solder a wire to the latter, and install in the slots in rear end



MULE PATTERN

TOP VIEW OF CHASSIS

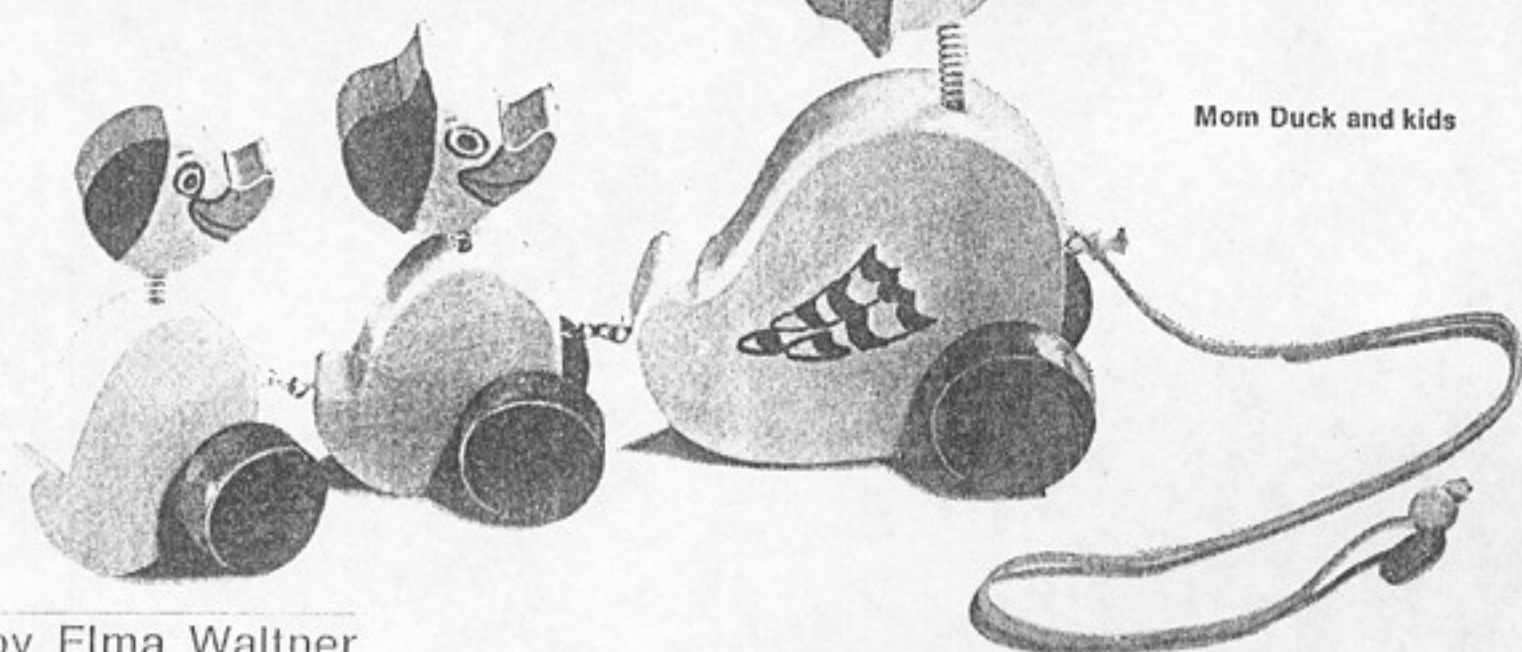


of the chassis, driving in brads to retain it. Mule's front hoof is pivoted in a slot.

Slot ends of axles with a thin hack-saw blade and after wheels are put on, drive a brad down through the slot at an angle. Paint chassis bright yellow and wheels red.—H.S.

Christmas gifts
you can make

Animal pull toys

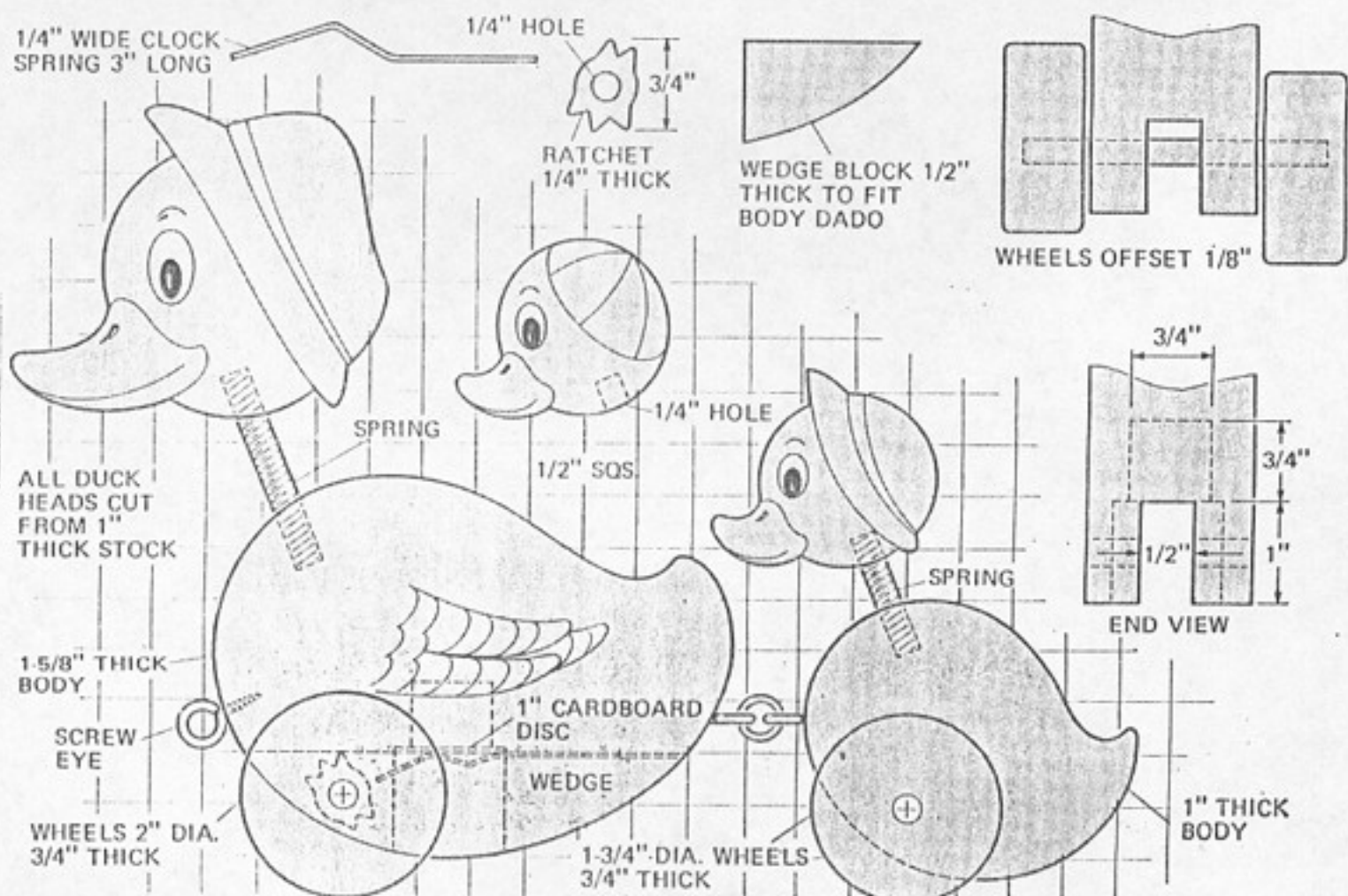


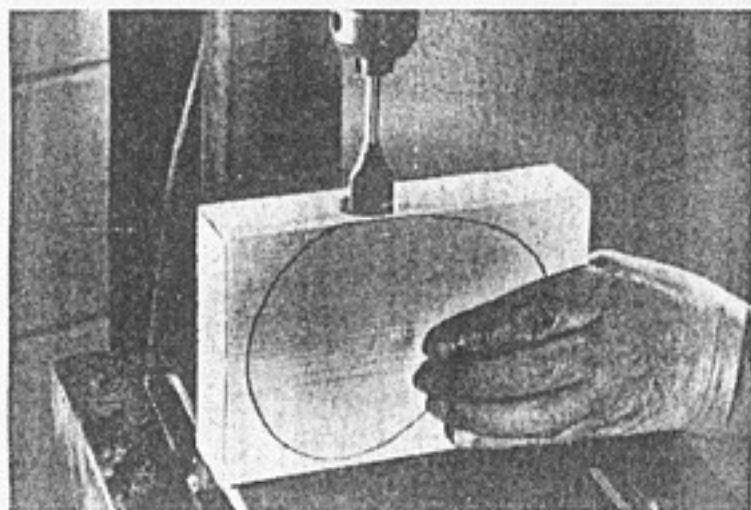
by Elma Waltner

Toddlers like toys they can pull, and if they are noisy, so much the better. Mom Duck and her kids waddle along quacking merrily, and Danny Dachshund makes himself heard as he is pulled. Off-center wheels provide the waddle, and compression-spring necks make the heads bob.

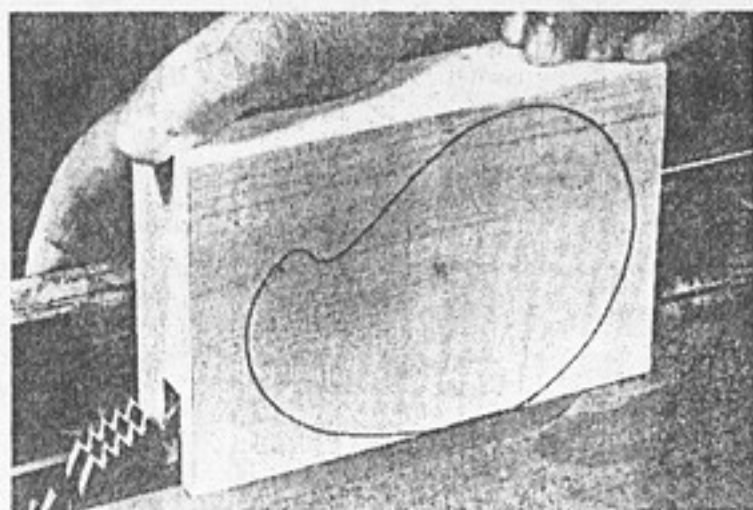
Both ducks and dog have the same voices, produced by pieces of clock spring being snapped against sounding boxes by hardwood ratchets.

The series of photos on the opposite page shows how the ducks are made. In each case, the voice-box holes are bored before

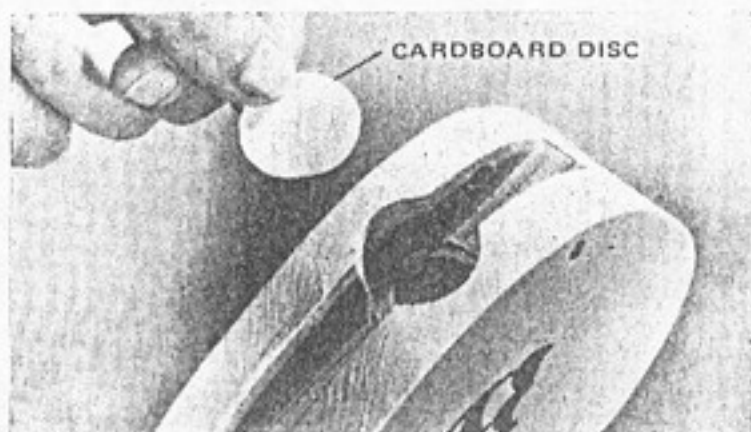




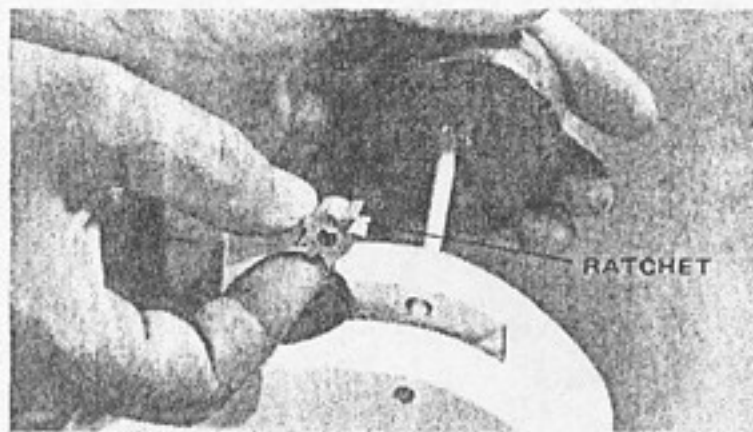
Sounding-box holes are bored in block before body is cut out. Drill 1-in. hole first, then $\frac{3}{4}$ in.



Block is passed over dado saw to form $\frac{1}{2}$ -inch.-wide slot in bottom edge, drilled for axles, then sawed.

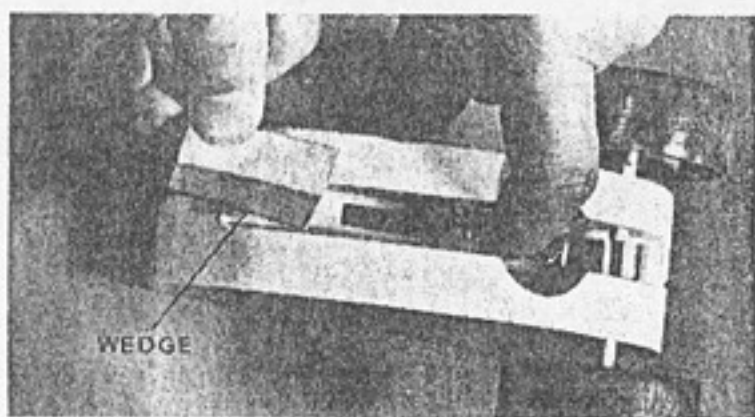
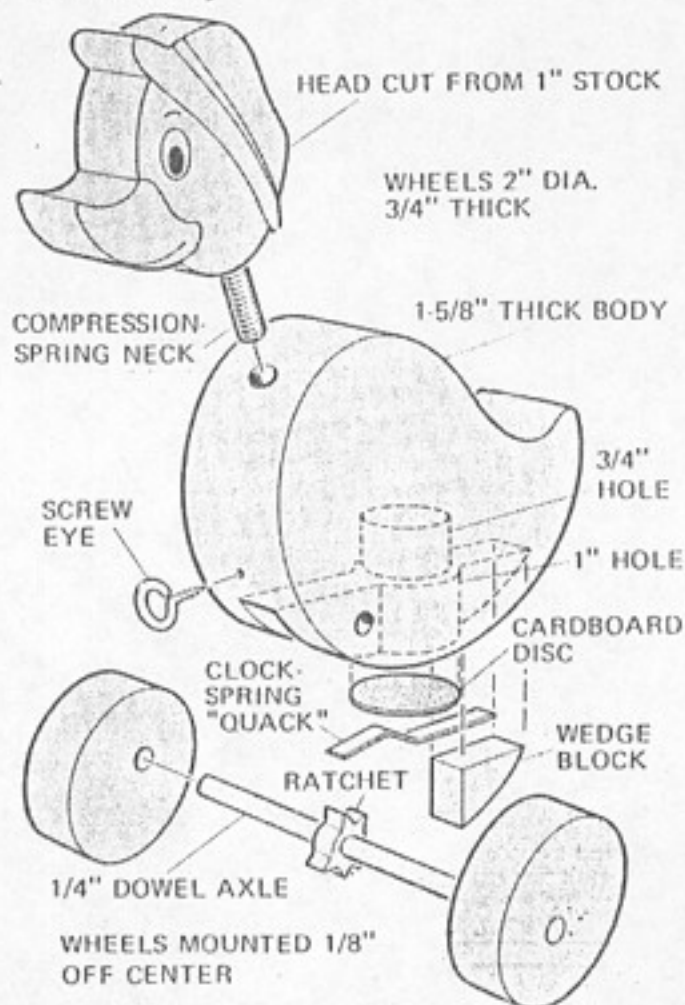


Thin cardboard disc is glued to ledge formed by large hole to cover the $\frac{3}{4}$ -in. sounding-box hole.

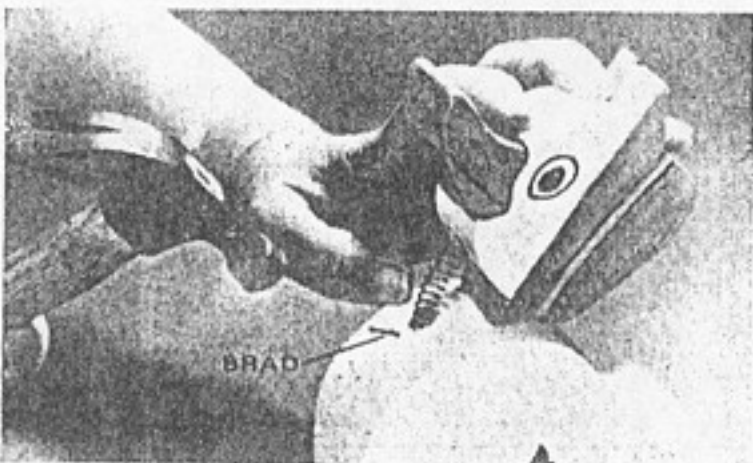


Ratchet is slipped over axle as it's passed through slot. Glue on each side holds ratchet on axle.

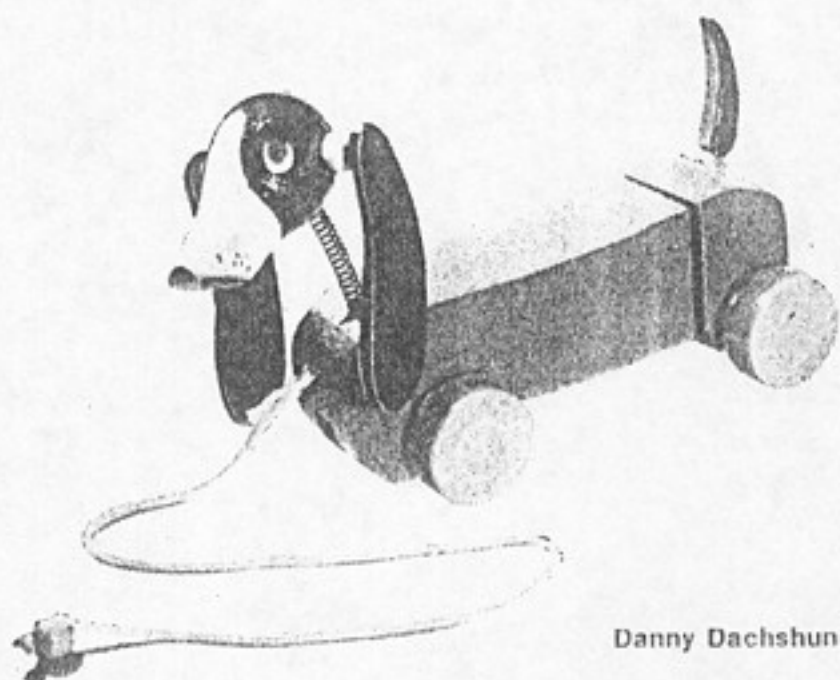
Duck assembly



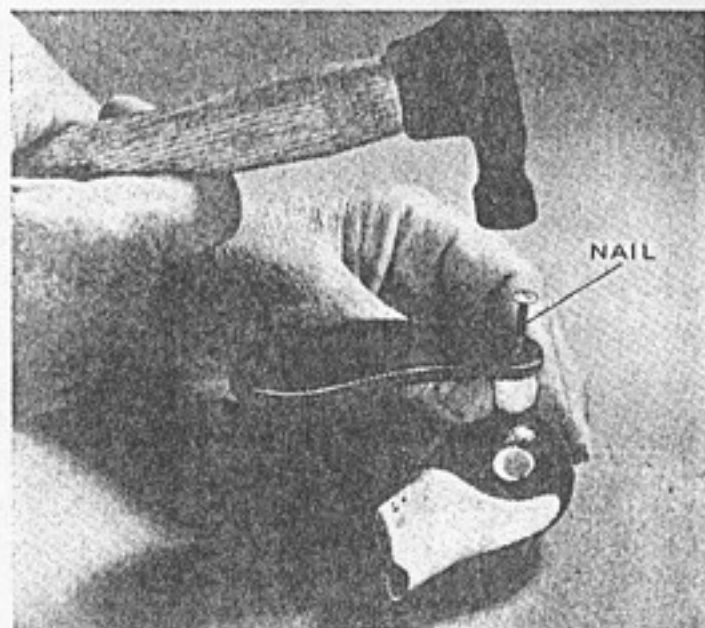
Apply glue to wedge block, then insert block in slot to hold spring against cardboard and ratchet.



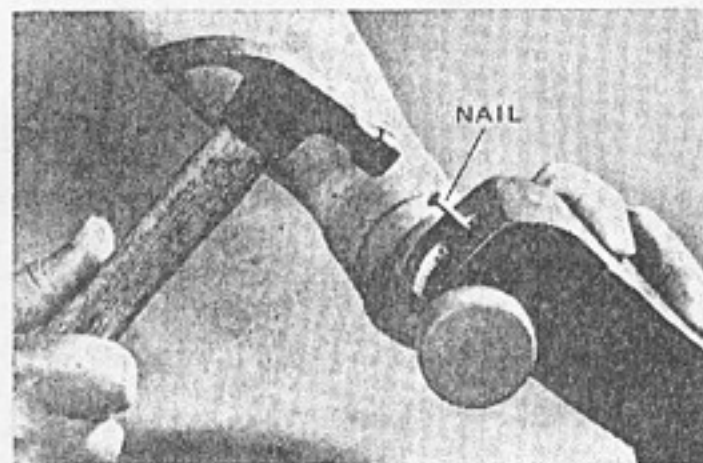
Small finishing nails, plus glue, are used to anchor neck springs in holes. Nails are driven crosswise.



Danny Dachshund



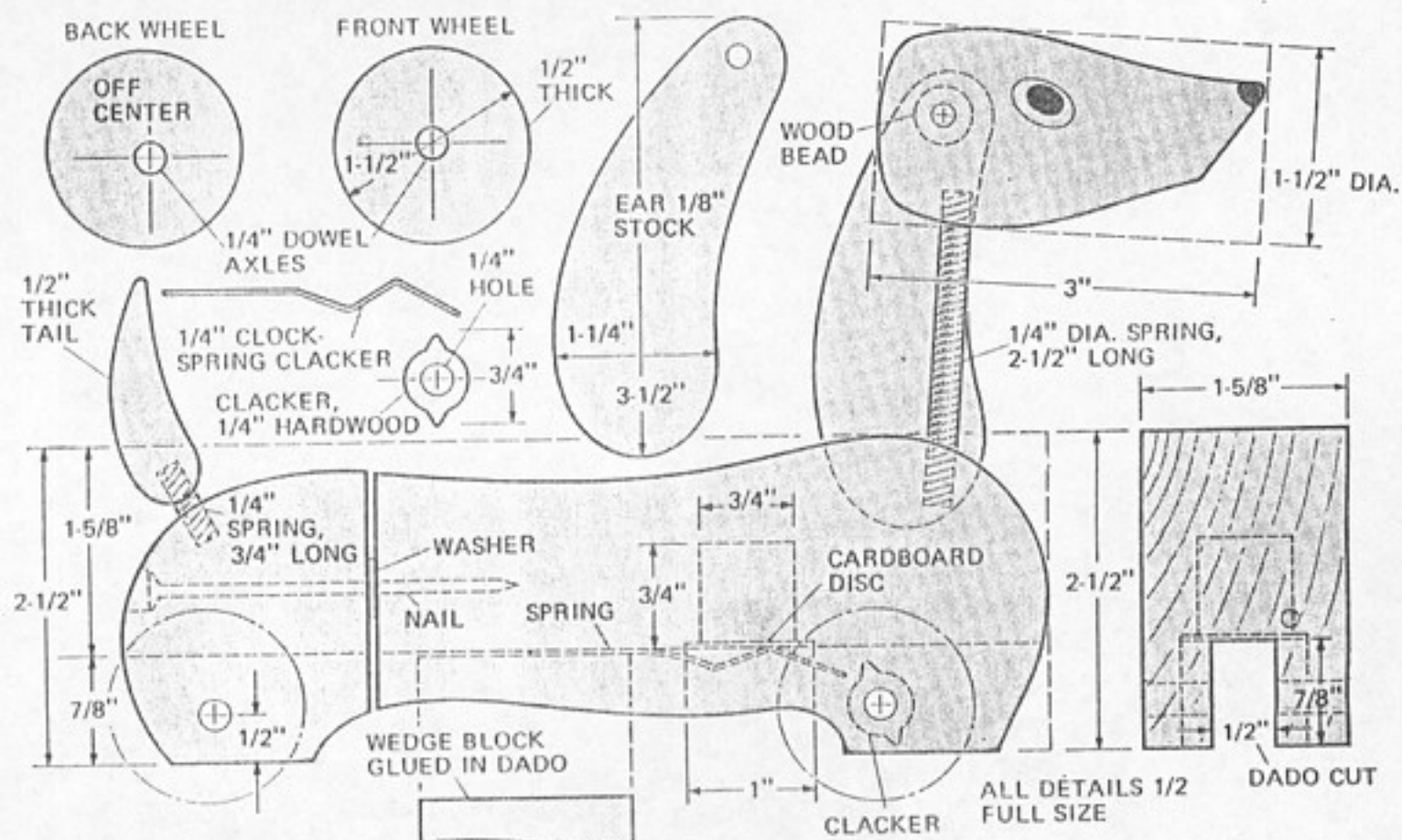
Attach ears to head by driving nails through oversize holes in ears, then through wooden beads.



Attach hind quarters to front section with washer between by driving nail through loose-fitting hole.

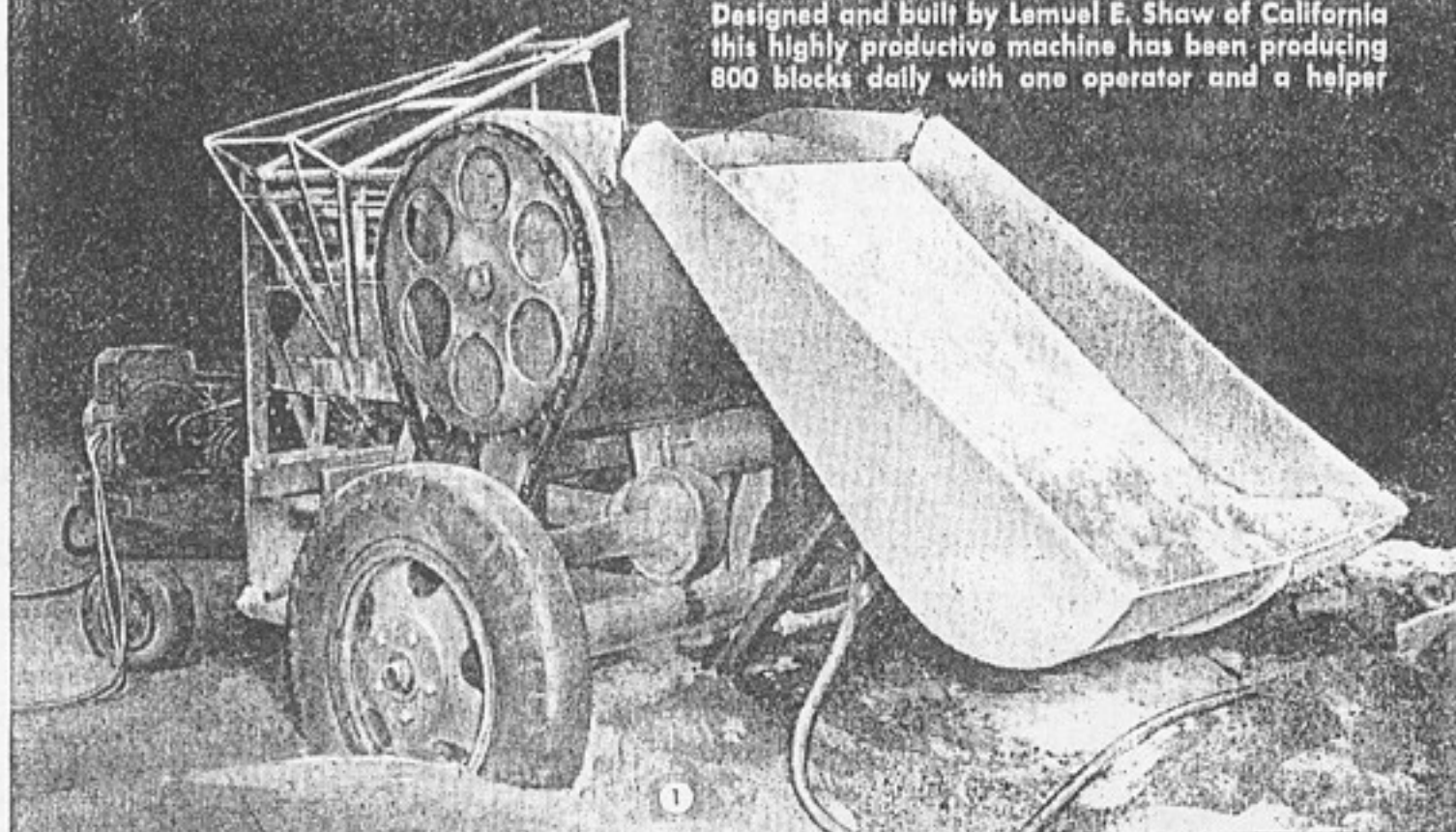
the blocks are slotted and sawed out. Postcard stock is just right for the cardboard sounding-box discs; a dab of glue holds the ratchet (clacker) on the axle and in center of the slot.

Basically, Danny is made the same way, the exception being that only his rear wheels are placed off center. Waddle is produced by attaching his hind quarters with a nail in an oversize hole. His head is lathe-turned and then cut off at an angle to form nose and mouth. Wheels can be cut quickly with a hole cutter. Sand all parts smooth and paint with a nontoxic enamel. ★ ★ ★



100 CONCRETE BLOCKS PER HOUR

Designed and built by Lemuel E. Shaw of California this highly productive machine has been producing 800 blocks daily with one operator and a helper

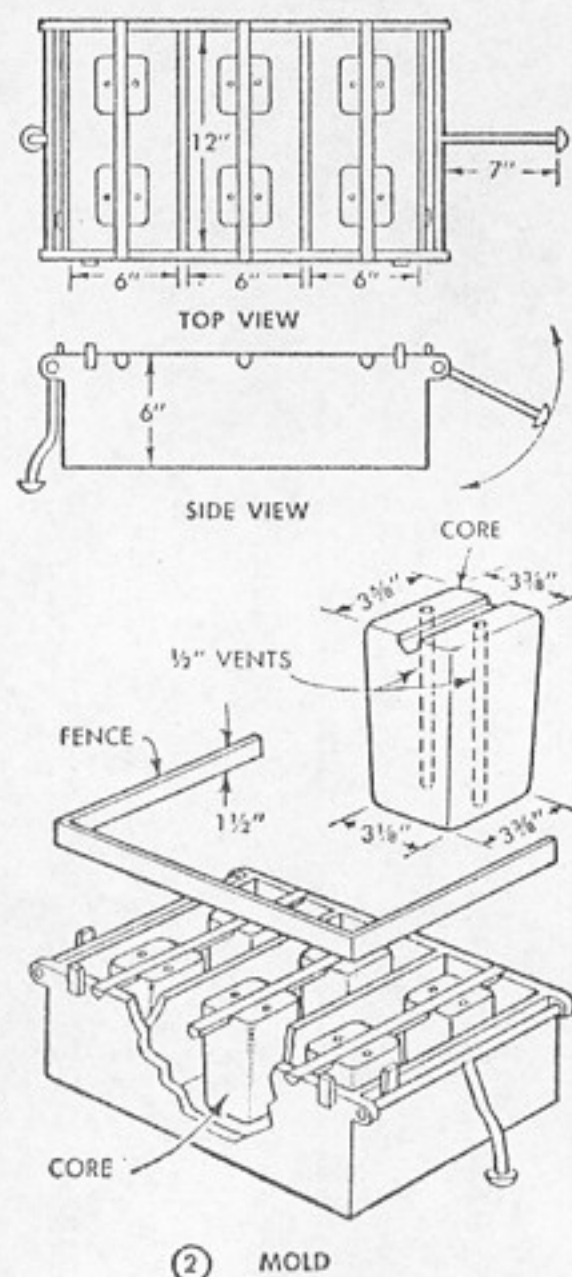
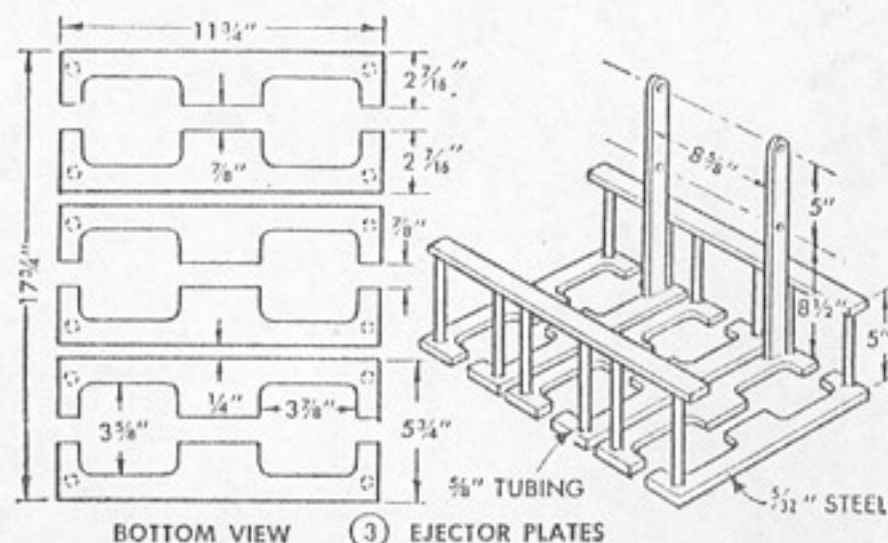


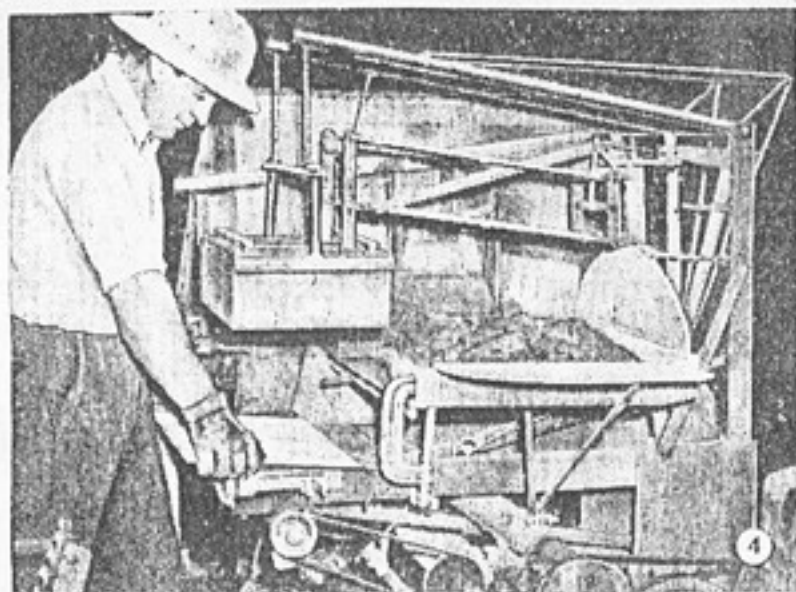
POPULAR MECHANICS, 1948

By Hi Sibley

THAT'S right! 100 blocks per hour — provided you have the help and the space and racks to cure the blocks properly. In Fig. 1 you see the outfit complete, ready for work. It's a self-contained unit mounted on its own two-wheeled, pneumatic-tired trailer with a supporting caster wheel under the drawbar. There's nothing to take apart and put together again when you move the machine. Merely disconnect the water hose and the power line, hitch it to a truck and away you go.

Figs. 4 to 7 inclusive show how it works. Fig. 2 details the metal mold and Fig. 3 the ejector plates and assembly. In Fig. 4 the mold, supported by a crane, is being lowered into place on the molding "board," in this case a steel plate somewhat larger than the mold. In Fig. 5 the mix is being scraped and troweled into the mold. When full the mold is



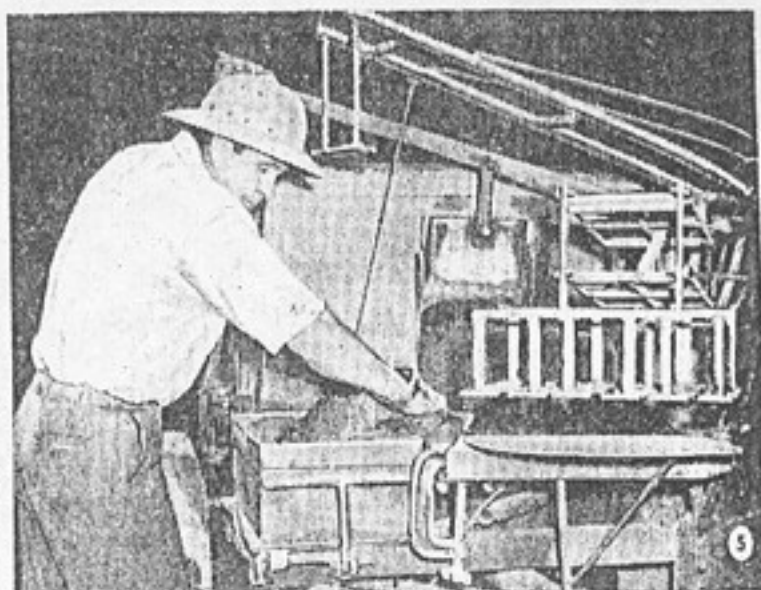


First step is placing the molding "board" on the vibrator arms. Some material from the discharge door of the mixer is on the platform above the mold, which is still supported in the raised position

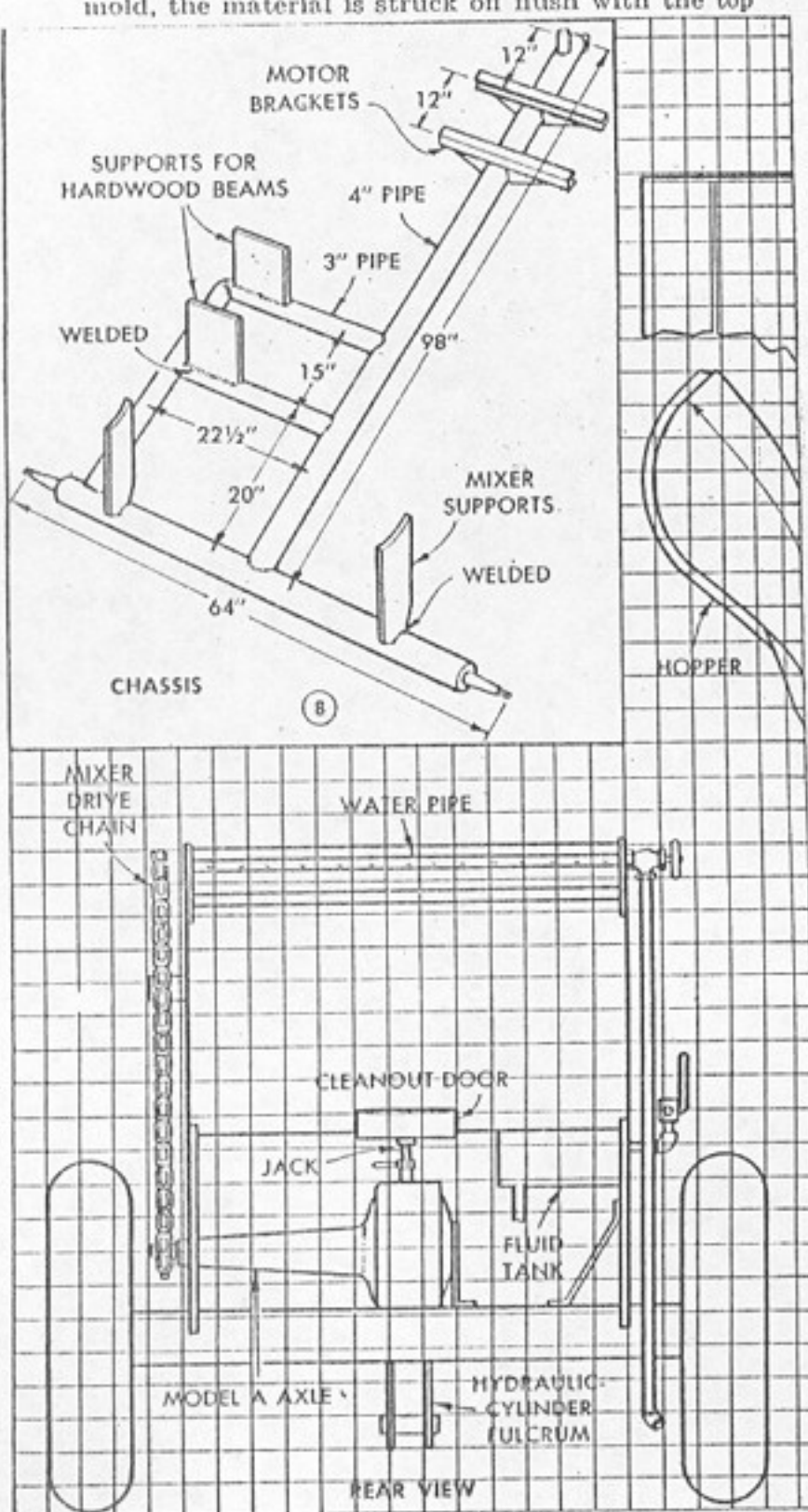
vibrated by means of a foot-operated take-off drive, and then the excess material is struck off the top with the fence or striker board. Next, the crane is hooked to the mold and the ejector is swung into place. In Fig. 6 the operator bears down on the ejector and simultaneously presses a foot pedal to raise the mold off the formed blocks. In Fig. 7 the finished blocks are being moved to the curing racks.

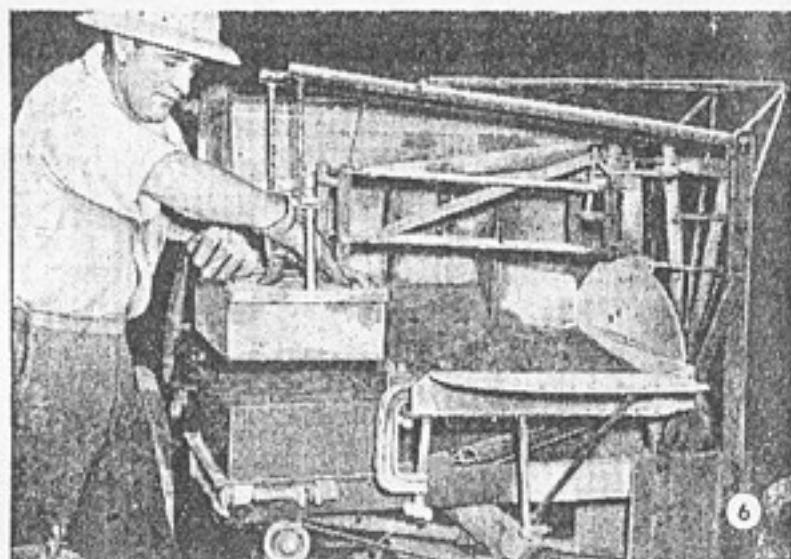
Fig. 8 shows the main frame, entirely a welded job using 3 and 4-in. pipe, steel plate and steel channel. Only general dimensions are given as some of these parts must be sized to fit during the assembly of other parts of the machine. With the exception of the motor, which is only a representation, the crosshatched views in Fig. 9 are intended to give a general guide to proportionate sizes of the machine parts and their relative positions. To make the manner of assembly more clear, certain parts have been omitted from these details. No detailed dimensions have been given in Fig. 9 because these will vary somewhat according to the materials and parts which you have or which are available.

Figs. 10 to 15 inclusive show the assembly. From these details you will see first that the main drive from the motor to the mixing chamber is made from a Ford Model-A rear axle and drive shaft, Fig. 11. One axle housing is removed and the open end of the differential housing is covered with a sheet-metal disk bolted on with a gasket between to prevent leakage of lubricant. A roller-chain drive sprocket is welded or keyed to the axle and a 2-step V-pulley is attached to the drive shaft. The drive thus formed from this unit is welded to the trailer frame at three points: at the

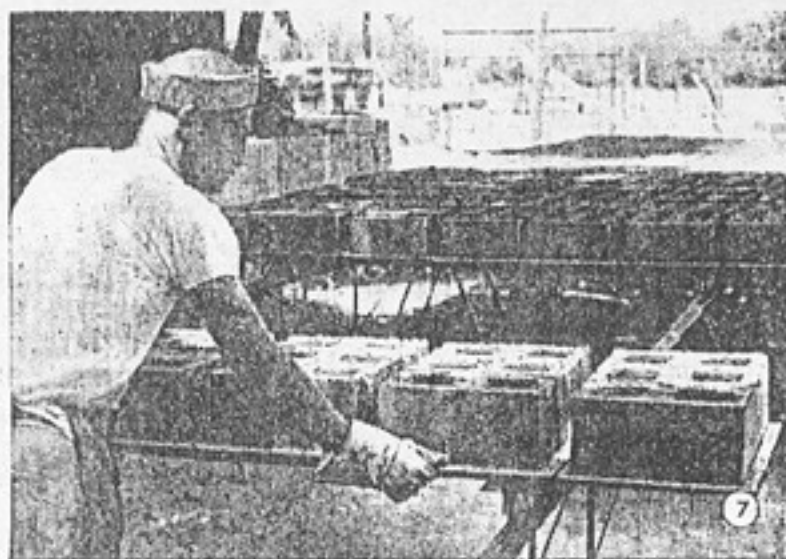


Here the hold has been lowered and locked, the crane released and ejector swung aside. Operator is filling mold. After filling and vibrating the mold, the material is struck off flush with the top

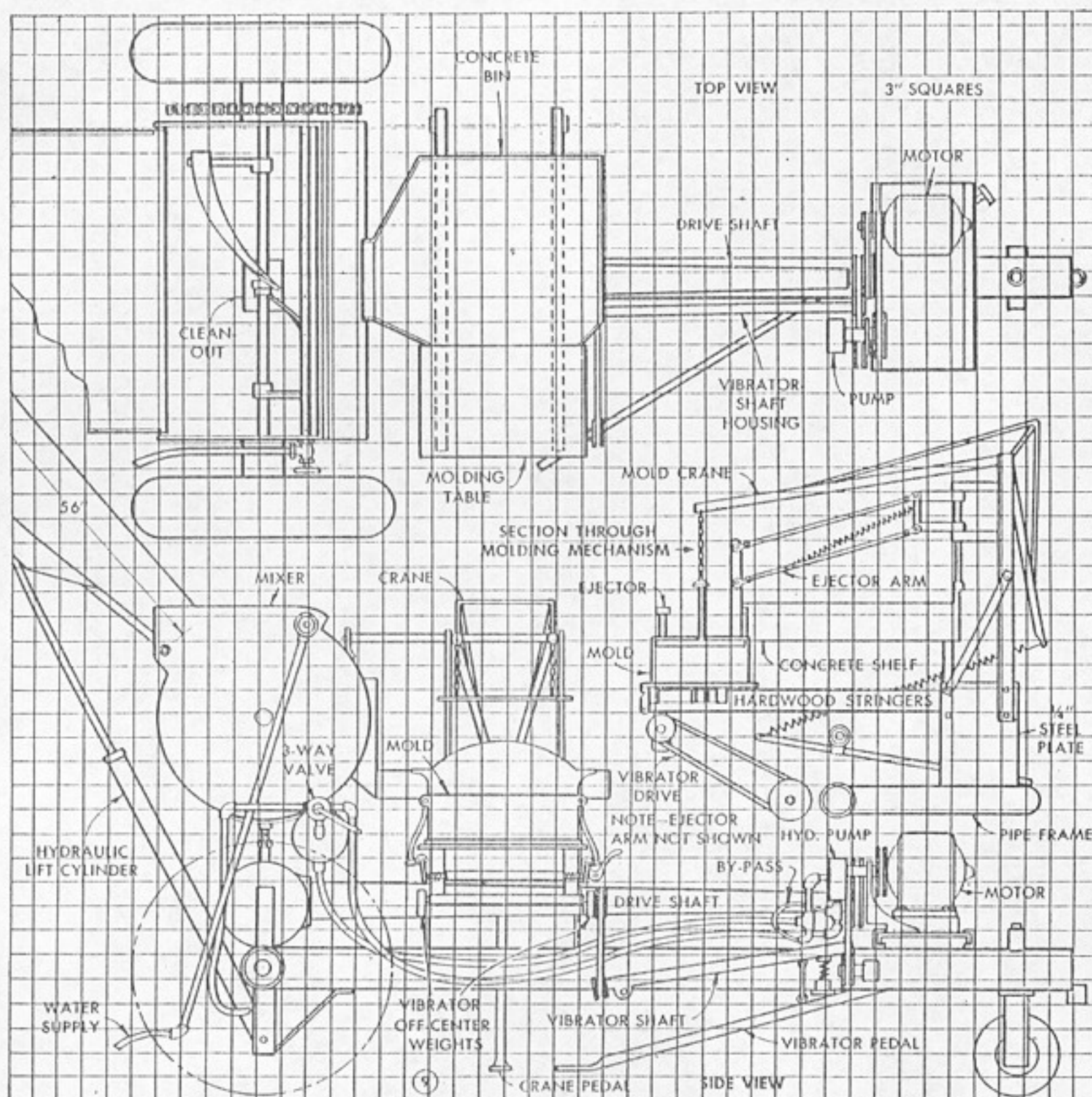




Next, crane is attached to mold and the ejector swung into position. Holding the ejector down, operator depresses a pedal, lifting the mold. Then after moving the blocks, the process is repeated



Here's the final step—moving blocks to the curing yard on racks especially designed for the purpose. It usually is best to cure blocks in shade. They should not be handled until cured thoroughly

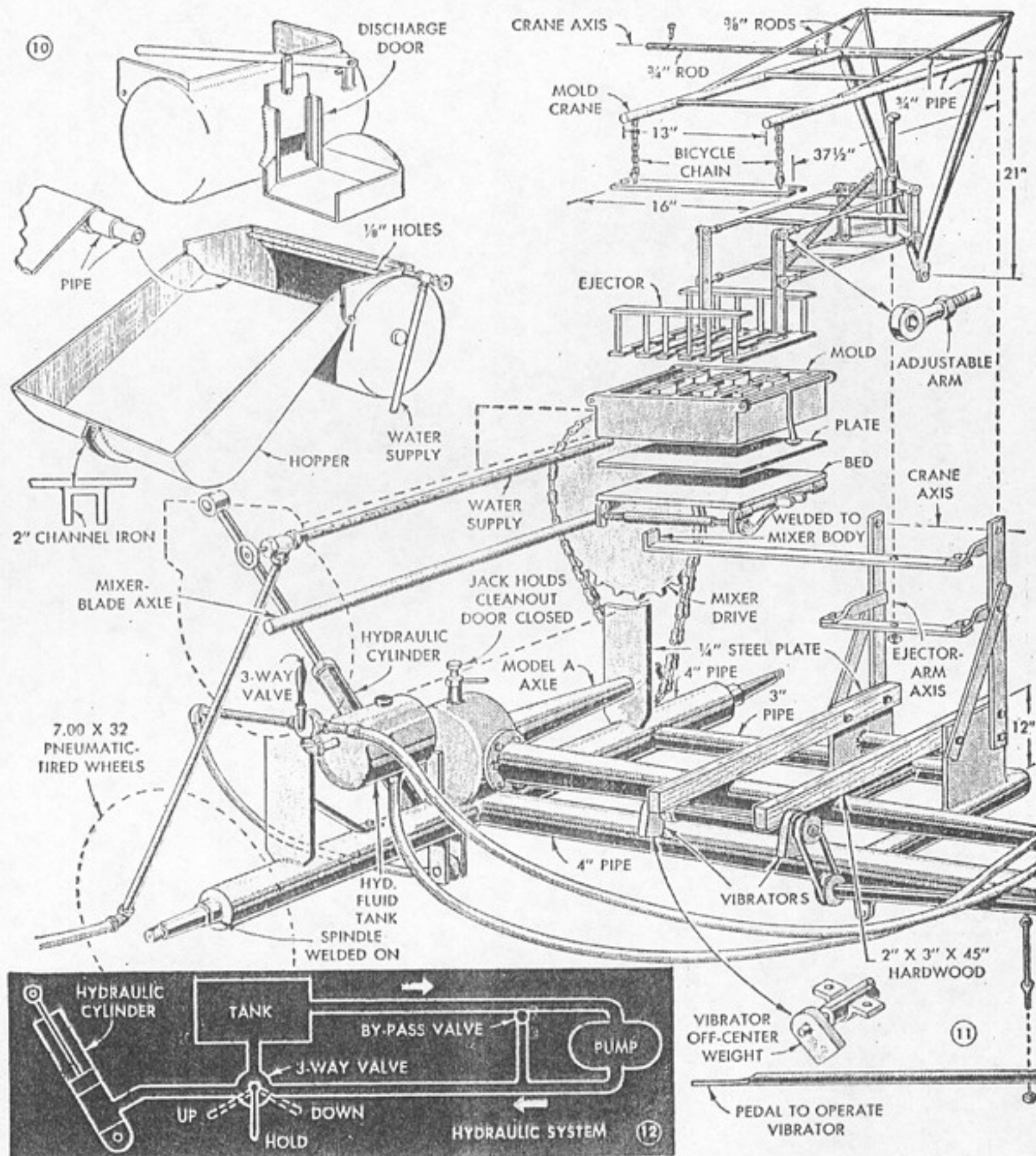


end of the Model-A axle housing where it passes through a hole in the mixing-drum bracket, and at the differential and the forward end of the drive-shaft housing, where it also is supported on brackets.

The hopper, Fig. 10, and the mixing drum are made of heavy sheet metal welded at all joints and reinforced with steel angles welded on as stiffeners wherever large areas of the metal are subjected to severe strain. The steel mixing blades of the agitator, Fig. 9, the top view, have a clearance of about 3 in. inside the drum.

Figs. 13 and 14 and the two upper views

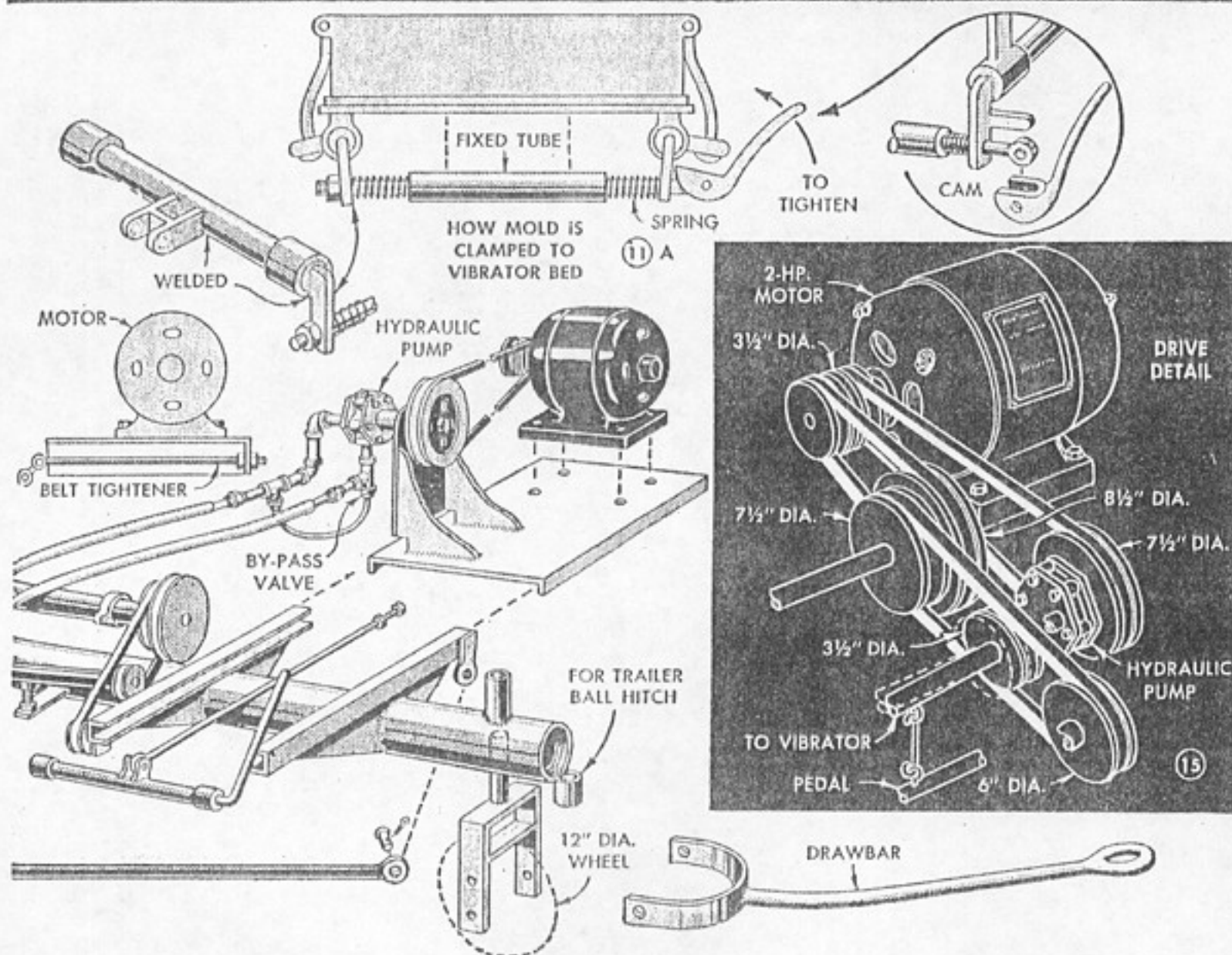
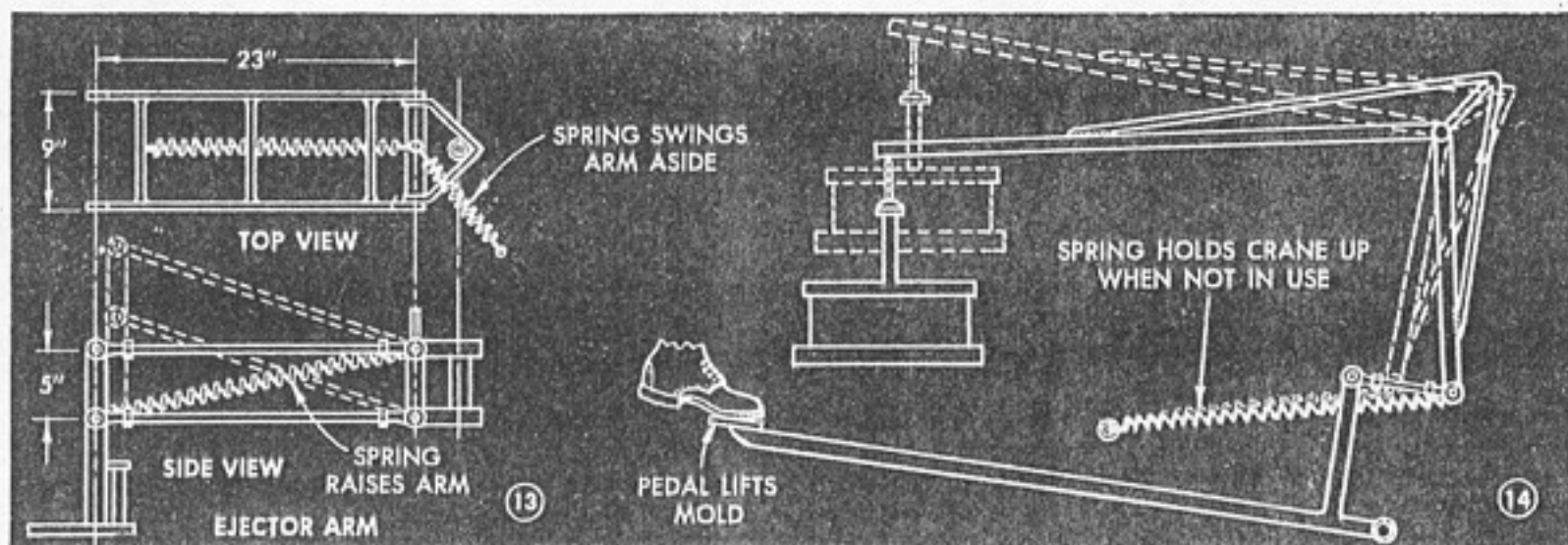
in Fig. 11 detail the crane and ejector arm. The crane is an all-welded assembly of standard rod and pipe sizes and is operated by a pedal which extends underneath the machine. However, the ejector mechanism is a somewhat more intricate affair. The ejector plates must raise and lower in the same plane, making two pairs of adjustable parallel arms necessary. A "helper" spring eases the lift of the assembly and another coil spring swings it to one side. Bearings at both ends of the four arms should fit accurately. Fig. 11 shows the frame which supports the crane and ejector.

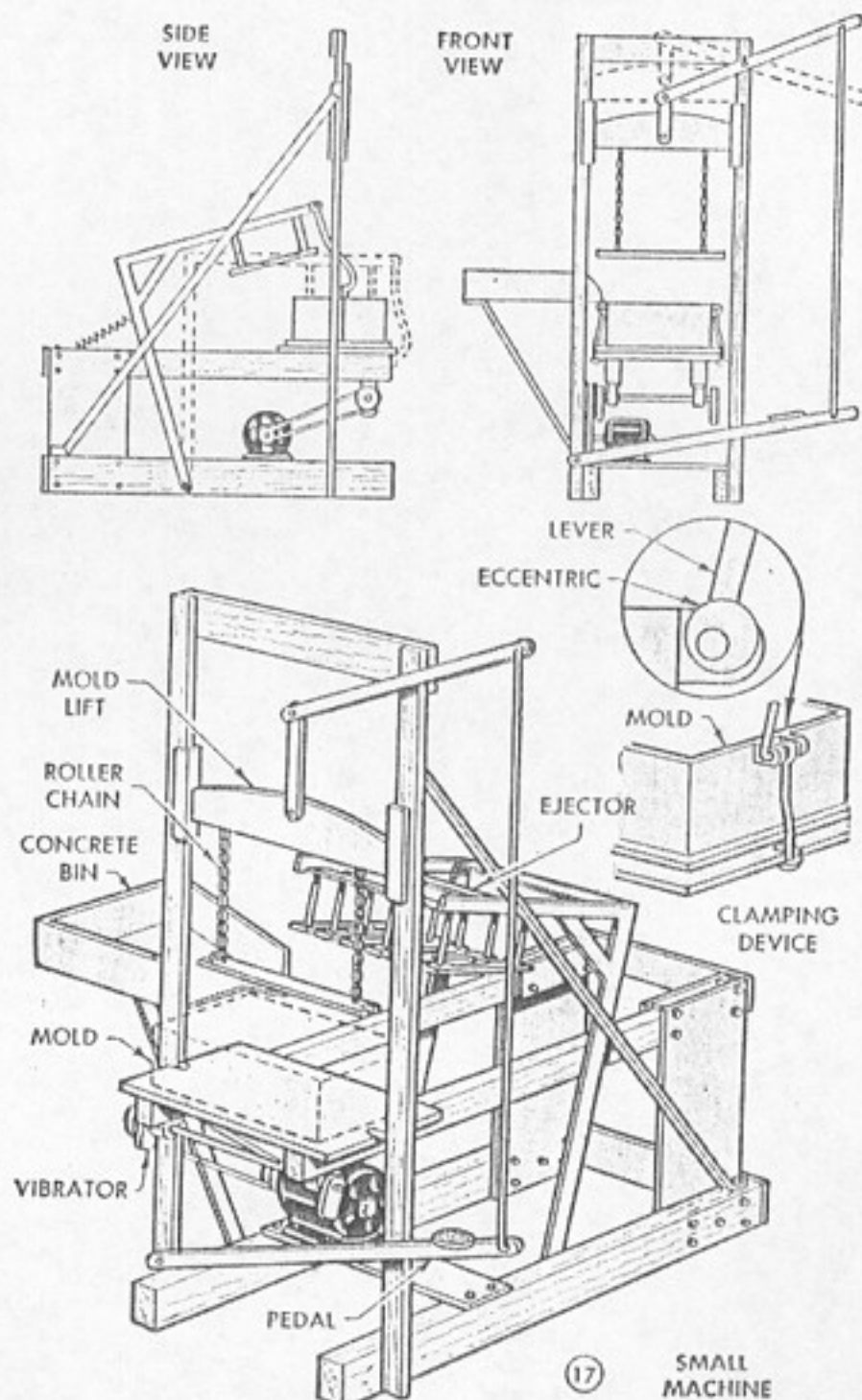
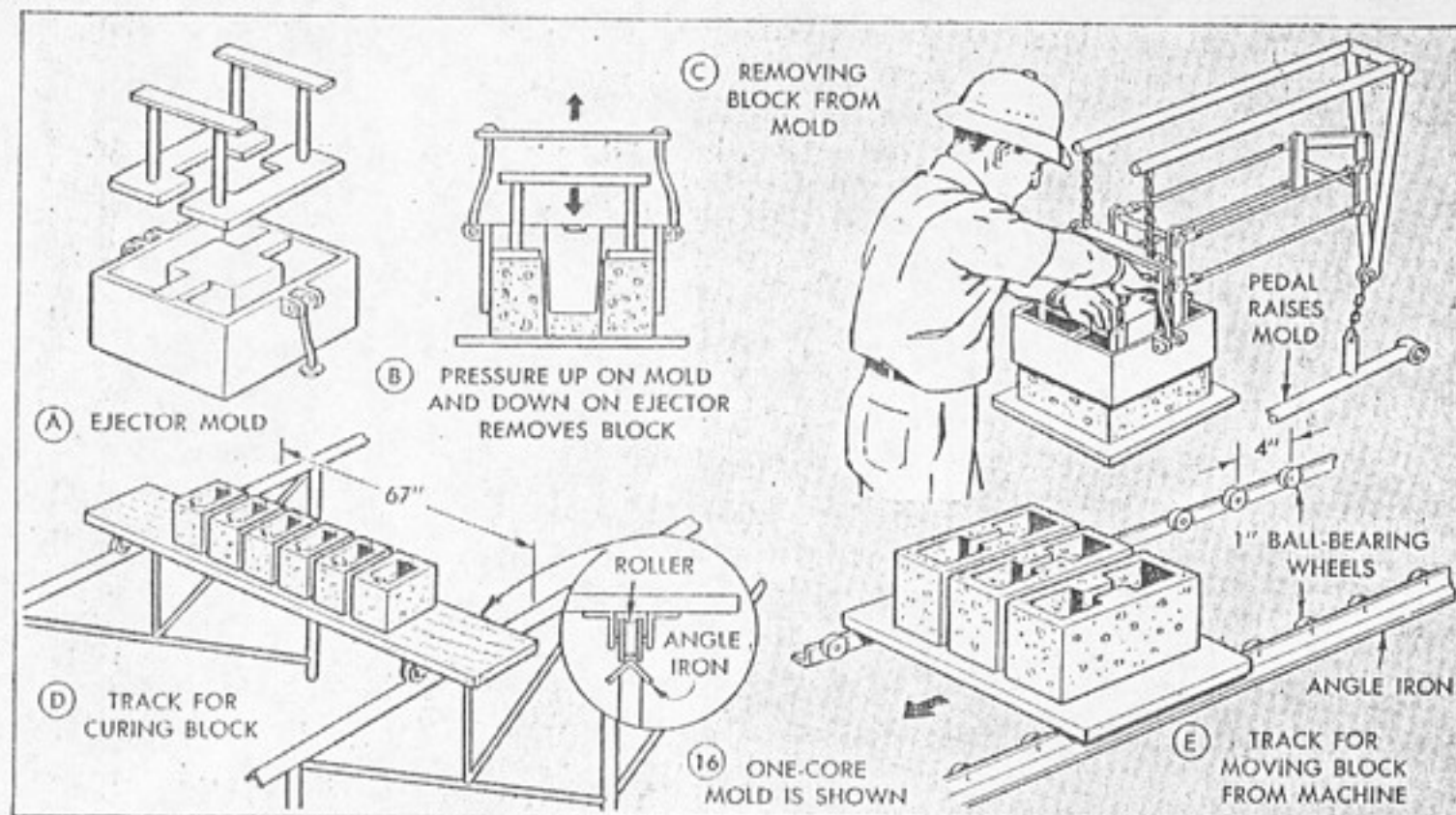


The hopper is raised for dumping by a hydraulic cylinder, Fig. 11. Arrangement of the hydraulic system is shown in Fig. 12; the drive to both the hydraulic pump and the mixer is detailed in Fig. 15. Raising and lowering of the hopper is controlled by a 3-way valve, Figs. 11 and 12. By-passing the hydraulic fluid allows the pump to be operated continuously, thereby simplifying the drive. The vibrator shaft, Fig. 15, is pedal-operated and runs only when the pedal is depressed. One belt from the two-step cone pulley passes around an idler. The pulley driving the vibrator is located

between the driving pulley and the idler as shown in Fig. 15. When the pedal is depressed the center pulley engages the belt, and "throw" of the off-center weights, Fig. 11, vibrates the mold. The mold must be held rigidly in place for this operation and Fig. 11A details the quick-acting clamping device especially made for this purpose.

The mold and the ejector, Figs. 2 and 3, are made for three blocks. There are two cores in each compartment of the mold and note especially that each core is vented, Fig. 2, and tapered slightly so that it will draw easily without breaking the edges of





the block. Cores can be cast from a rich cement-sand mixture or they can be made of heavy sheet metal, welded. Where facilities and materials are available, they also could be cast from aluminum.

Fig. 16, details A to E inclusive, shows a one-core mold, A and B, which is suitable for certain special types of blocks. Detail C supplements Fig. 6 and shows more clearly the procedure and placement of the hands in ejecting the block from the mold, while details D and E suggest types of elevated tracks or rails for moving blocks away from the machine and to the curing yard, as in Fig. 7. Curing racks of any convenient size may be assembled from hardwood boards, steel angles and flanged rollers as in Fig. 16 D. Detail E suggests one way of providing for easy handling of the blocks from the machine to the curing racks.

General assembly views of a hand-operated machine for making a few blocks at a time are given in Fig. 17. Here most of the work is done by hand, only the vibrator being motor driven. It's easy to build for either a one, two or three-block mold. Proportions of the mix which have been found most satisfactory are 7 parts pea gravel, 12 parts sharp sand, 2 parts silt and $2\frac{1}{2}$ parts portland cement. The amount of water is determined by experiment as it depends on the dampness of the aggregate.



Philip Mahan demonstrates how a fish is transferred from the fry tank to the barrel.

RAISING CATFISH IN A BARREL

A biological food chain in the back yard produces fresh fish for the table and compost for the garden.

*Organic Gardening and Farming
November, 1973*

PHILIP AND JOYCE MAHAN

AFTER SOME STUDY and experimentation, we have set up a productive food chain—table scraps to earthworms to catfish—in our back yard. The project is satisfactory in many respects, utilizing waste materials to produce fresh fish for food and at the same time yielding ample compost for a small garden. The material cost is minimal. The whole operation

can be set up for less than \$15.00. The equipment occupies only about 12 square feet of space, and the entire assembly can be easily moved if necessary.

The materials can be very simple: Two 55-gallon steel drums, three panes of glass 24 inches square, and a medium-sized aquarium air pump. One of the drums will serve as a tank

for the fish, oxygen being supplied by the air pump; and the second drum should be cut in half to provide two bins for the worms. The panes of glass are used as covers for the worm bins and fish tank, and for ease and safety in handling can be framed with scrap lumber.

We chose catfish because they are readily available in our part of Alabama, and reach eating size in a summer. Various small members of the sunfish family, such as bluegill or bream, would also be suitable.

For information on raising channel catfish, we relied on studies made at Auburn University in Alabama, as well as on the work done at Skidway Institute of Oceanography for the Georgia Fish and Game commission where fish were raised in tanks. The commercial growers from whom we got our fry and fingerlings raised their eyebrows considerably at the idea of growing fish in a barrel and feeding them earthworms; but they did not actually discourage us. While we readily admit that our plan has no commercial possibilities, we know that we can produce, for our own table, tasty fresh fish that is uncontaminated and costs practically nothing, both considerations being highly relevant at this time.

Fish are usually efficient food producers; a one-pound fish yields approximately 10 ounces of food. Further efficiency is indicated by the fact that fish fed on commercial fish ration convert about 85 percent of their food to meat. While we are not prepared to compute the technical data about food conversion in fish on an earthworm diet, we can readily state that the fish relish earthworms, and do grow well on this food.

The Auburn experiments showed that fish could be grown in large numbers in confinement, and the Georgia study confirmed these findings. Although there is some relationship between the number of fish and the volume of water in which they

are grown, the most important variable according to the Georgia study was the rate of water turn-over. Spraying the water back into the tank aerates the water and at the same time releases the ammonia produced by excretory matter in the water. Because the oxygen requirements of fish are quite high, the faster the circulation of the water, the faster the growth of the fish.

We decided to keep our equipment as simple and inexpensive as possible at the beginning, but to use the maximum stocking density of the Georgia experiments, keeping 40 fish in a 55-gallon drum. Although inexpensive circulation pumps are available, we chose to use a METAFRAME HUSH II aquarium bubbler for oxygenation and a garden hose to siphon off water from the bottom of the barrel.

We take off 15 gallons of water per day, but as we run the waste water onto the worm beds and adjacent garden, the cost is negligible. Although we have creek water close at hand, we were advised to use city water to avoid the introduction of undesirable algae and fungi that might be harmful to the fish. Because city water is usually quite highly chlorinated, it is necessary to draw the water in 5-gallon buckets and let it stand for a day in the sun before emptying it into the drum to replace the water siphoned off. We have seen no evidence of oxygen starvation in the fish with this method of water circulation.

The most important variable we have found is water temperature. Catfish will feed at temperatures as low as 40 or 45 degrees, but their greatest growth is achieved at 84 degrees. We noticed a decided increase in feeding activity when we painted the barrel black and moved it into full sun. Leaving the buckets of water in the sun not only speeds chlorine dissipation, but warms the water as

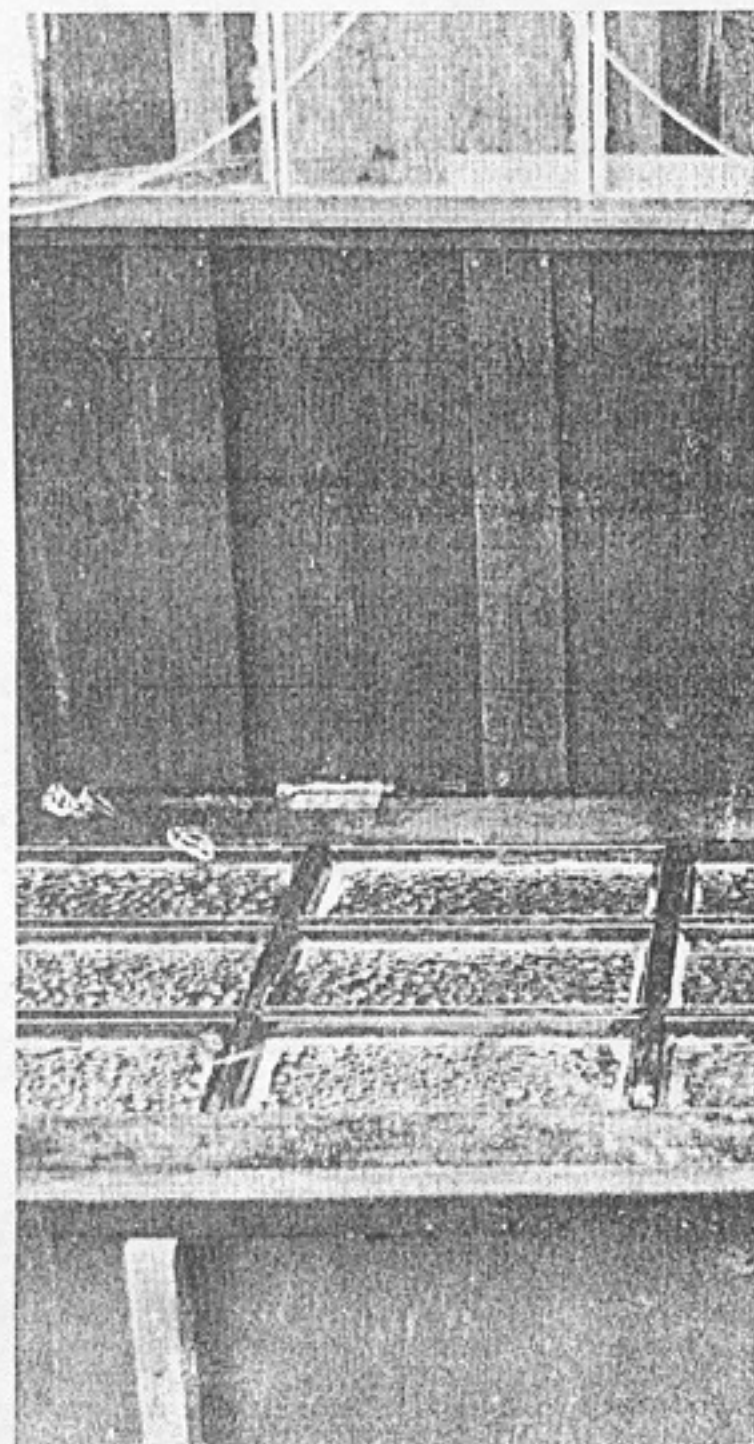
well. In areas where city water temperatures are close to the growth optimum, the chlorine can be removed by setting the hose nozzle at fine spray, and the barrel can then be filled directly from the water supply. Although summer growth is greatest, the project continues throughout the year. By judicious use of sun when possible, plus auxiliary heat when necessary, winter growth can be kept at a fairly high level.

When water temperatures are right, the fish will feed so enthusiastically that they may leap completely out of the barrel. For this reason, the top of the barrel should be covered completely with a pane of glass which will also help in keeping the water warm. Because fish feed most eagerly in late evening and early morning, we feed them at these times of the day. As with earthworms, care must be taken not to overfeed. In warm water and bright sunlight, any uneaten worms will die and decompose rapidly, giving off gases which are poisonous to the fish.

Transferring any grown animal to a confining environment produces the equivalent of cultural shock, and is followed by a period when feeding is light and growth is slow. At this time special care must be taken not to overfeed. Unless fish can be found that have been hatched and grown in a tank, small fish should be selected to stock the barrel, as their adaptation time is proportionally shorter than that of larger fish. To eliminate as much transplanting shock as possible, we use a large wooden box, lined with two layers of polyethylene sheeting and covered with an old door, to stock with fry. By the time the fry reach fingerling size, they can be transferred to the barrel as replacements are needed, and very little shock is evident. An insect lamp over an opening in the cover of the fry tank permits the small fish to eat at night while ridding the garden of night-flying pests.

Earthworms, as any angler knows, are food for fish in their natural habitat; and most fish in captivity prefer live food to the dehydrated type. Kitchen scraps make excellent food for earthworms; and even the most careful organizer will have enough refuse to feed, quite handsomely, 5,000 to 10,000 worms.

We found that growing earthworms at home is not difficult. The basic materials are easily arranged, and the earthworms' demands are simple. All they require are a protective container, reasonable temperature control, adequate moisture, not too much food, and a light, loose



bedding which is never allowed to become acid.

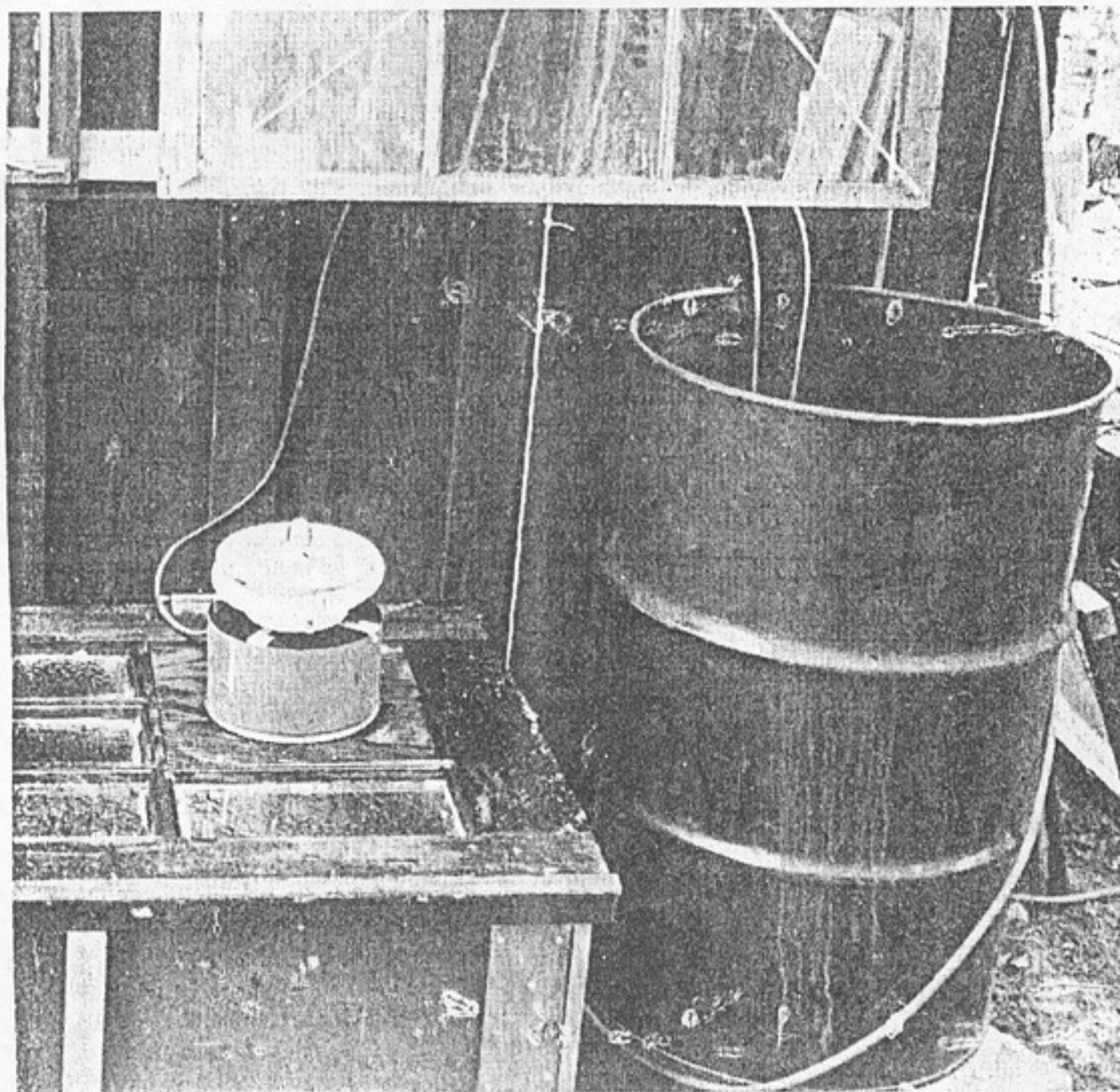
The steel half drums are ideal worm bins as they are effective protection against the earthworms' predators in addition to being quite inexpensive. They have the added advantage of being movable so that as cold weather approaches, the worms can be carried to an enclosed porch or basement to continue composting activity and fish food production throughout the winter.

Each half-drum will house between 4,000 and 6,000 worms. The two half-drums are utilized most effectively if they are alternated so that the worm

population is allowed to build up in one, while the second supplies the fish food. The eggs that remain after the worms are removed will serve to start a new supply when the first drum is converted to feeding.

Worms will start breeding when they are about 90 days old. Each worm, possessing reproductive organs of both sexes, will produce an egg capsule per week, containing from three to 25 eggs apiece. The most economical way to establish worm bins for a home food-chain and composting operation is to begin with capsules. Although a little more time is required initially, there will ulti-

The 55-gallon drum to the right is for raising fingerlings to eating size. The lid of the fry tank (left) houses an insect lamp which provides food for the young fish.



mately be more worms available to work with. Under the protected conditions of a worm bin, the survival rate of young worms is very high.

The type of worm selected is not important. There are two compost-bait types raised commercially — usually known as “brown-nosed worms” and “red wrigglers.” Either type may be purchased from most dealers.

The bedding for the worm bins may be any organic material that is water-absorbent and does not pack so as to exclude oxygen and impede the worms’ movement. Leaves and old straw are good, as is aged sawdust soaked in several waters for a week or so. Ground peat moss, being odorless, is ideal if the worms are to be kept inside. Soil should never be used as it contains no nutriment and is likely to pack.

It is safe to assume that earthworms can eat any kitchen scraps except citrus rings, vinegar dressings, and bones. Though they eat almost anything given them, their intake of food, and likewise the production of compost, can be increased by frequently feeding foods that are especially tasty to them. The prime consideration is to avoid overfeeding. Although worms thrive on decaying food, they should never be given more they can consume in 24 hours.

The dangers of acidity cannot be overemphasized. It is the only real hazard in worm raising. Acid bedding frequently destroys an entire worm farm in a few weeks. To maintain accurate control over the acidity, one should use a soil test kit or a pH test strip of the type used by industrial and medical laboratories. Tests should be made at least once a week, and the pH factor (degree of acidity) should remain between 5.5 and 6.5 on the scale. A reading of 5.0 or below means danger, and immediate steps must be taken to neutralize the bedding with an application of pure ground agricultural lime-

stone. *It is important to read the label carefully to verify that the limestone does not contain any added phosphates which also bring disaster to a worm bed.*

The drums should be located in an area protected from temperature extremes. Optimum temperatures for feeding and growth are between 60 and 70 degrees, but worms will thrive in most summer climates if the beds are well shaded and the bedding is kept loose. During the summer months, the bedding must be sprinkled daily, but it should never grow soggy. The glass tops on the half drums serve to conserve moisture, but they will not prevent crawling. Worms have a tendency to roam at night during damp or rainy weather unless preventive measures are taken. A small light over the bed is an effective deterrent to their wanderings, while an equally effective measure is to cut a remnant of carpet to fit the drum exactly and lay this on top of the bedding.

The table scrap-earthworm-catfish food chain, even from its inception, was never intended to evolve into a money-making project. It was simply an effort toward a better way of life through cooperation with the forces of nature; and in this respect, our project has been a complete success in more than one way.

First of all, we have a regular supply of fresh fish at minimal cost. A seven-ounce catfish fingerling grows to 25 ounces in a summer, thus producing a pound of food in four months. In the second place, we have netted ample compost for our vegetable garden, thereby further insuring a low-cost and nutritive food supply. In addition, and perhaps this is the greatest benefit of all, we have the satisfaction of working with growing things and the gratification of knowing that we have not wasted the earth’s resources. We have made an elementary biologic principle work in our own back yard.

IF YOU'RE THINKING OF RAISING CATFISH

EDITORIAL NOTE: Because we believe many of our readers will want to raise catfish on their homesteads, we referred this article to Dr. William O. McLarney, of the New Alchemy Institute, Woods Hole, Massachusetts, for review. The questions he raised were then referred to authors Philip and Joyce Mahan, whose replies appear below.

The fish were channel catfish.

Our fish were not fed exclusively on earthworms in that we started them on commercial catfish food. Because it is very difficult to teach pond-grown fish to eat in confinement, we offered them exactly the same food they had been eating in the pond. We continued these rations for about four weeks before their response was sufficiently enthusiastic to risk changing food. Then the earthworms were introduced gradually — a few at a time — until the fish accepted them. Some of the fish recognized the worms as food immediately, and within a week the water literally boiled when the worms were thrown in. We wondered, then, if they might not have started eating more readily if we had used the worms initially.

Weight of fish: We don't have any figures at all on the weight of the fish we started with, and we didn't weigh any before we ate them. As we stated in the article, we began with 40 fish — fingerling size. Although we arrived at this number on the basis of Auburn's ratio of water volume to total fish weight, our computations were based on the weight as estimated by the fish farmer from whom we got the fingerlings. He didn't weigh the fish and we don't remember what that estimated weight was. We didn't know this thing was going to work.

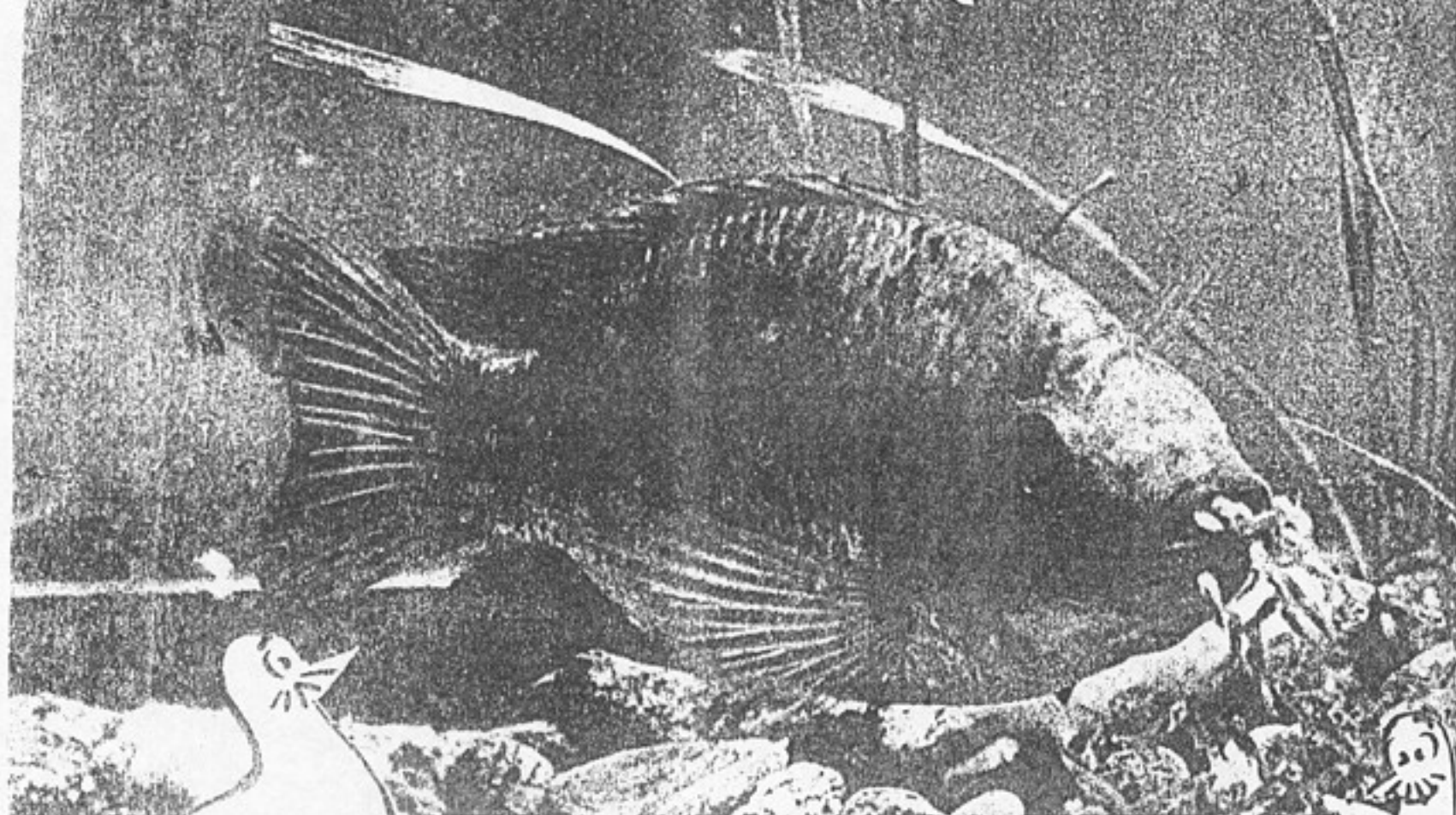
Earthworms: Again we have no figures on pounds of worms used. For reasons of ethics (we advertise in OGF), we didn't mention in the article that we are in the worm business. Since we have so many worms around, it just didn't occur to us to keep records of how many we used. We simply tossed the worms into the barrel until the fish stopped eating. We fed once a day, but we don't think that all of the fish ate at every feeding. I would estimate an average of 75-100 worms per day. The worms

were small, not weighing more than an ounce per hundred. We were careful not to feed breeders to the fish.

Table scraps: We have been feeding table scraps to earthworms for a number of years; and to date, we have not weighed a single scrap. We can, however, offer fairly precise figures on this step. Earthworms are reputed to produce their own weight in compost daily; but our experience has not indicated that they really do. A thousand worms weigh 13 or 14 ounces, but daily feeding per thousand does not approach that weight. We usually keep a container of around 2,000 composting worms in the kitchen, and I give them a couple of tablespoons of selected (that is to say, soft and mushy) scraps each day. In liquid measure this amount would be only two ounces.

It never occurred to us that a nutritional deficiency might develop in fish fed only on earthworms. I doubt that either of us would have recognized malnutrition if it had occurred. As we don't have backgrounds in biochemistry, we are not in a position to make any statements concerning the nutritive value, qualitative or quantitative, of earthworms. We did definitely notice a considerable increase in feeding activity when we started giving worms. In fact, we ate our first fish — seven of them — when they were only ten inches long because they jumped out of the barrel, and we didn't want to put them back for fear they had been injured. We feed our tropical fish (Red Oscars) earthworms also, but we can't continue the diet for more than two months at a time because the fish get so lively and eager for food that they leap out of the aquarium whenever we lift the cover for feeding. I would say we are inclined to agree that earthworms are a near-perfect fish food.

The UN's Happy Shmoo



Doting mama tilapia protectively takes youngsters into mouth.

Eats next to nothing, can live anywhere,
reproduces like mad, tastes fine boiled,
baked or fried—here's one terrific fish!

By John Tiger

Mechanix Illustrated

January, 1955

ESKIMO chiefs, lighthouse keepers and missionaries who have spent the past seven years in the remotest jungles of darkest Africa may not have heard about the shmoo, a bizarre beast created by cartoonist Al Capp, but almost everyone else this side of the Iron Curtain chuckled at the strange little critter whose sole aim in life was to be eaten by human beings. Broiled, fried, roasted or baked, the shmoo died happy in the thought that he tasted wonderful. Today, a bunch of energetic U. N. scientists has come up with an amazing postscript for Li'l Abner fans in a dozen lands, for the international organization is busy distributing a shmoo fish of its own.

Absolutely delicious broiled, fried, dried,

salted, smoked or pickled, the wonder fish being promoted so enthusiastically by the U. N.'s Food and Agriculture Organization is the quick-growing, fast-loving *tilapia*. A member of the carp family, the *tilapia* reproduces at such an incredible rate and attains maturity—i.e., eating size—so rapidly that it has won the proud title of "the mad fish of Thailand." It eats like mad, grows like mad and reproduces like mad.

As one dazzled American reporter announced after a quick peek: "It reaches the age of consent in four months, and the answer is invariably yes." Two weeks later there are 502 *tilapia*. Joyful statisticians of the Royal Thai Fisheries Department, who are cooperating with the F.A.O. and Uncle

Sam's Foreign Operations Administration in the greatest experiment since Anna met the King, report that two tilapia—of opposite sex, natch!—can produce 10,000 more in a single year.

This is definitely good news to the protein-starved people of a score of "underdeveloped" tropical lands where tens of millions cannot afford to buy the essential meat, fish or eggs which healthy bodies require. Zooming cigarette costs a few years ago spurred many thrifty Yankees to roll their own, and now the answer to prohibitive prices for protein products in Asia is for the ordinary citizen to grow his own.

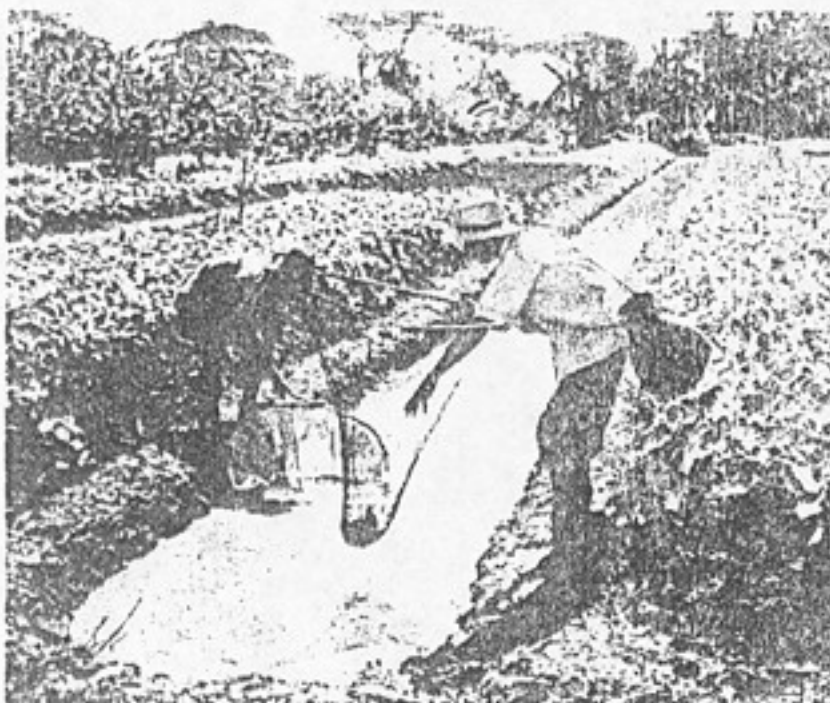
It's almost too easy, so simple that a lot of poor farmers in old Siam couldn't quite believe it for months. The tilapia is fairly new to Siam, but has a decade and a half of achievement in South East Asia. For it was in 1939 that a Dutch colonial fisheries expert spotted a few swimming in a back country lagoon in what was then the Netherlands East Indies. He was amazed to see them, for the native habitat of this delicious denizen of the deep is the waters and ponds of Mozambique. No one has ever learned just how the tilapia navigated the 5,000 mile journey from the Portuguese colony on the eastern coast of Africa.

The Dutch expert didn't have too much of an opportunity to study the question himself, although he thought about it during the long years he spent in a Japanese prison camp. When he emerged in 1945, he was astounded to find that the mad fish had been reproducing at such a loony rate that the local population was devouring literally millions each year. Annual consumption had reached tens of thousands of tons by 1944, and the ambitious Nipponese tried to cash in on the deal by claiming that they had imported the free-loving shmoo fish to help the Indonesians.

By 1949 the Netherlands East Indies had become the young Republic of Indonesia and Siam had become Thailand, but the tilapia was still the tilapia. The underwater

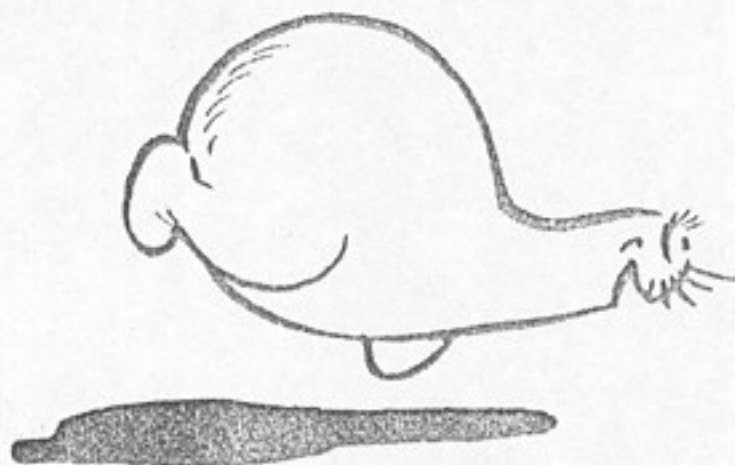


Dr. S. Ling, UN's ace fish culturist and shmoo's best friend in Siam, shows trainees the latest method of shipping baby tilapia—by plastic bag.



The boys fish themselves a tasty snack. Siamese farmers find tilapia thrives in drainage canals, barrels, tanks—that shmoo really lives it up!

Below, Fisheries Director Nai Boon and shmoo fan Dr. Ling point out fish folkways to King Phumiphon of Thailand. In royal pond shmoo lives like king.



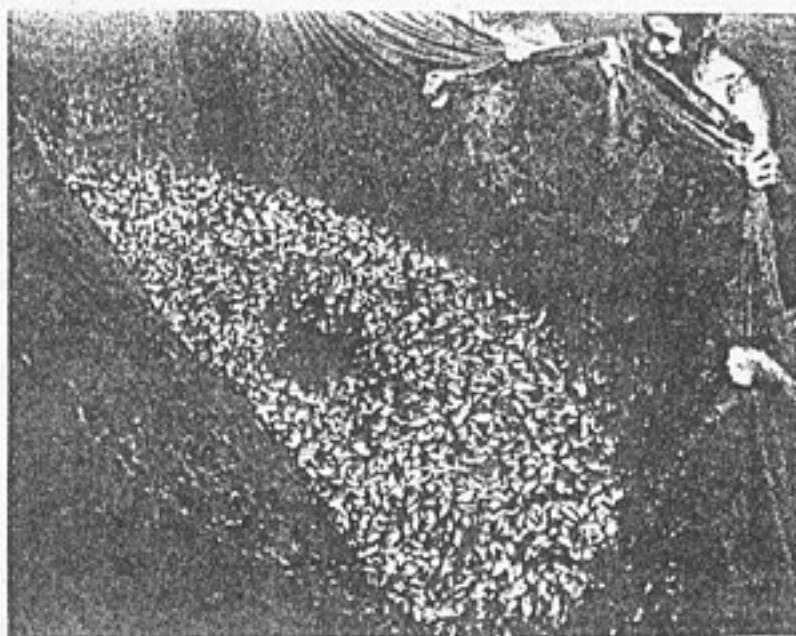
A grateful nod to United Feature Syndicate for permission to reproduce Al Capp's famous shmoo.



Thailand government is drum-beating to interest heavily populated areas in possibilities of the shmoo. Here Thai family merrily reels in a meal.

shmoo was living it up in the Philippines and Malaya too, for those governments had been impressed by the Indonesian reports. The Royal Thai Fisheries Department decided to join the fish fry, and imported a test batch from Penang, Malaya, in August 1949. In 1950 another 200 fish were ordered from Singapore and the Food and Agriculture Organization was asked to send expert advisors.

Recognizing that many of the Thai farmers were malnourished because of protein deficiency in their diets, the F.A.O. agreed to assign its ace fish culturist, Dr. S. W. Ling to initiate the program. He demonstrated in a dozen tests that the amazing tilapia (1) can live in fresh or brackish water, streams, lagoons, ponds, swamps, drainage ditches, irrigation canals, flooded rice paddies, tanks or even wooden barrels; (2) attain maturity at four months and breed all year round at three month intervals to give four big crops a year; (3) require no particular kind of feed and can live on small aquatic plants and animals, although they welcome additional snacks of rice bran (the husk that is thrown away) and inexpensive coconut meal. (4) are good insect and worm eaters, keep down the growth of mosquito larvae and lower the malaria rate, and help clean many injurious insects from ponds and paddy fields; (5) help prevent clogging of drainage and irrigation ditches by consuming large quantities of submerged aquatic plants; (6) help fertilize the pond water, for the plants and insects they eat are quickly digested and become useful manure, plus the fact that their habit of plowing among the bottom humus in search of food exposes organic substances for speedier decomposition to become useful fertilizers. Dr. Ling joined forces with Royal



A catch of fingerlings for distribution to Thai farms. Siamese call tilapia "King's magic fish." Tilapia hasn't reached U. S. yet. Give it time.

Fisheries' Director Nai Boon Indrambarya to spread the fertile fish around.

They launched their sales campaign by distributing small numbers of baby tilapia to farmers coming into town for agricultural fairs and religious festivals. A typical tale is that of Mr. Nai Udom, curious but frankly skeptical, who took home a score of little fish from his November, 1950, visit to the Nakorn Phathom Temple Fair. After keeping the carefree critters in an earthen trough in his back yard for a few months, he built a fish pond and tossed the tilapia in with some ordinary carp cousins. Less than half a year later the happy Mr. Udom, by then an enthusiastic fish farmer, had a couple of thousand tilapia and has since generously given away many thousands more to awed neighbors.

News of this amazing fish spread like wildfire through the rural population as such success stories circulated, and by the end of 1951 some 150,000 fingerlings—each less than an inch long—had been distributed. Growing like mad and breeding like mad, these added up to a couple of million good cheap meals and left a few million relatives behind to carry on their noble endeavors. Another 400,000 baby tilapia were given away to dazzled Siamese farmers in 1952, and by early 1953 the tilapia population of the kingdom was cheerfully estimated at 20,000,000 to 25,000,000. Even the efficient F.A.O. experts find it tough to keep up with the fertile fish.

By 1953, Uncle Sam's Mutual Security Agency (now Harold Stassen's Foreign Operations Administration), sat up and took official notice of the frantic fish which offered new hope for better living to many of our allies in the tropics. The alert MSA press officer in Bangkok, Emerson

Waldman, got an okay to produce 5,000 pamphlets on the terrific tilapia but soon had to dash to the printer for another 200,000 as public interest zoomed. Everything connected with the tilapia moves fast.

The whole kingdom went on a tilapia kick that was crazy, man, real crazy. European educated King Phumiphol, a real gone monarch who writes jazz tunes strictly for kicks, decided that this little fish was simply the end and staged an elaborate ceremony with his lovely Queen Sirikit and the royal court in attendance as the United Nations' F.A.O. wizards released 2,000 of the wonder fish into the ponds at the great palace at Hua Hin. His Royal Highness nearly flipped when he heard that only one fingerling had died on the 20 hour trip thanks to a specially equipped truck featuring fish tanks with continuous water circulation and oxygen supply.

The regal tilapia of Hua Hin have been reproducing like—well, like tilapia—and thousands of their heirs have been given to grateful country folk who refer to them as "the King's magic fish." Dr. Ling and his Thai colleagues insist that there is nothing supernatural in the blitz-breeding of this crazy carp. The female lays her eggs long enough for the papa tilapia to fertilize them and then picks them up in her mouth. She totes them around for a full fortnight, during which time she's living on love because she can't open up to eat. After two weeks, the little quarter-inch offspring swim out but she sticks close to them. Should any menace approach, the mama fish inhales the tiny mob back into her mouth for safety.

After the King tossed the torrid tilapia a royal plug on a palace broadcast, the Prime Minister and a gang of other officials piled on the fishwagon. So did thousands of ordinary citizens, and this year the government was handing out 600,000 tilapia fingerlings every month. During the impressive Siamese New Year ceremonies last April, richly costumed young girls placed shmoo fish in temple pools as part of ancient religious rites.

Soldiers and convicts are being taught fish farming as a useful occupation, and 25,000 acres of swamps, tanks and public waters have been stocked. Add the more than 10,000 private ponds converted to "fish culture," and you can see that the tilapia is here to stay.

Not only is the critter cheap, useful and tasty, but it's a darn good cash crop. After tests at the Bangken Fisheries Experiment Station showed Thai officials how 200 pair of mature tilapia can produce 113,000 young fish for distribution plus 21,700 mature tilapia in a single year, the experts pointed out that a

reasonably diligent "fish farmer" could make a 95% financial return in a year. If he used his own family as labor, the profits would be still greater. Many Siamese have reported recently that tilapia ponds bring in three times as much cash income as rice from an equal land area.

The tilapia has moved on—in five gallon cans of water and compressed oxygen—to Indochina, Pakistan and Burma. Protein-starved residents of Haiti and Jamaica in the Western Hemisphere are also munching away on tasty tilapia-burgers, and report that they are firmly fleshed and almost boneless. A dozen other hungry hot-weather lands look forward hopefully to the U.N.'s happy half-pounders.

While the fabulous shmoo fish is not likely to survive in non-tropic lands, F.A.O. experts have found that fish farming with other species is spreading to more temperate areas. Canada and Sweden's inland fisheries produced nearly 57,000 tons in 1952, and the U. S. catch was 68,000 tons. This isn't too much in comparison with the vast ocean catch, but the prospects for growth are good as thousands of Americans review the results of fish farming at home and abroad. Here is an unusual new do-it-yourself or rather grow-it-yourself program, one that can pay good profits if properly managed. Not only do the crops bring in a decent cash income without too much work, but the F.A.O. has found that the establishment of fish ponds also aids soil conservation projects. Some southern states offer interesting possibilities in small swamps too, and this marshy land is usually unused and inexpensive. Yet experience in the Far East has demonstrated that fish farming is feasible in just such areas.

Information on the U.N. fish programs and techniques can be secured from either of the Food and Agriculture Organization's two U.S. offices, one in the United Nations Secretariat Building in New York City and the other at 1325 C Street S.W., Washington 25, D. C. To secure detailed facts and figures, booklets and tips on fish farming possibilities in your area, check with the Wildlife and Fisheries Service of the U. S. Department of the Interior, Washington 25, D. C. Even if you can't latch onto the U. N.'s happy shmoo, there is still a chance for fun and profit in this new kind of farming. •

CATFISH & TILAPIA YOUNG

WILLIAM B. de Yampert
Mainline Fisheries/Crystal Fish
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Big Business From Odd Jobs

A youngster, fresh from school, found there was money in the odd jobs neighbors asked him to do. He bought equipment on time and now, at 18, earns \$15,000 a year.

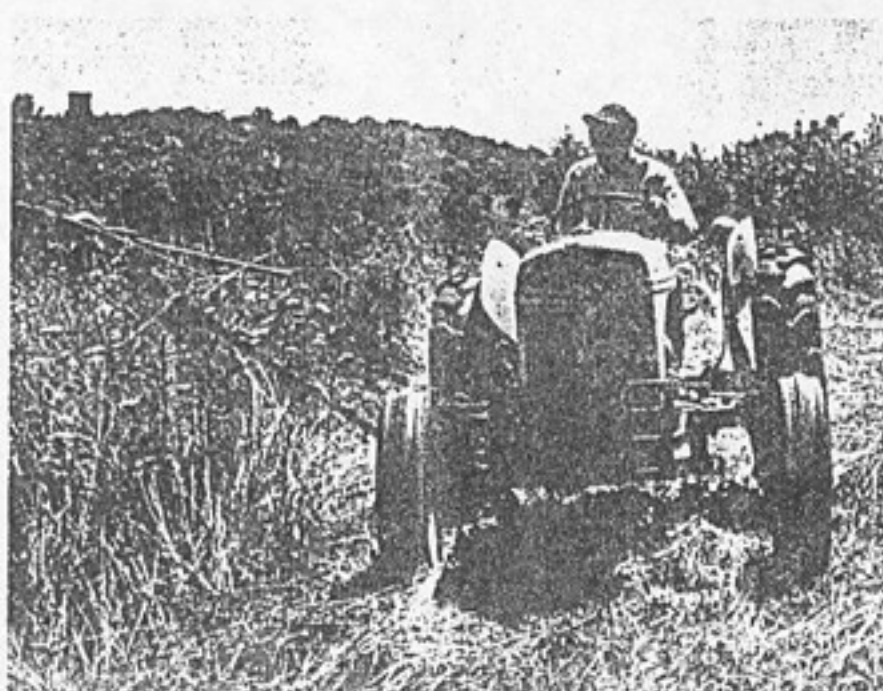
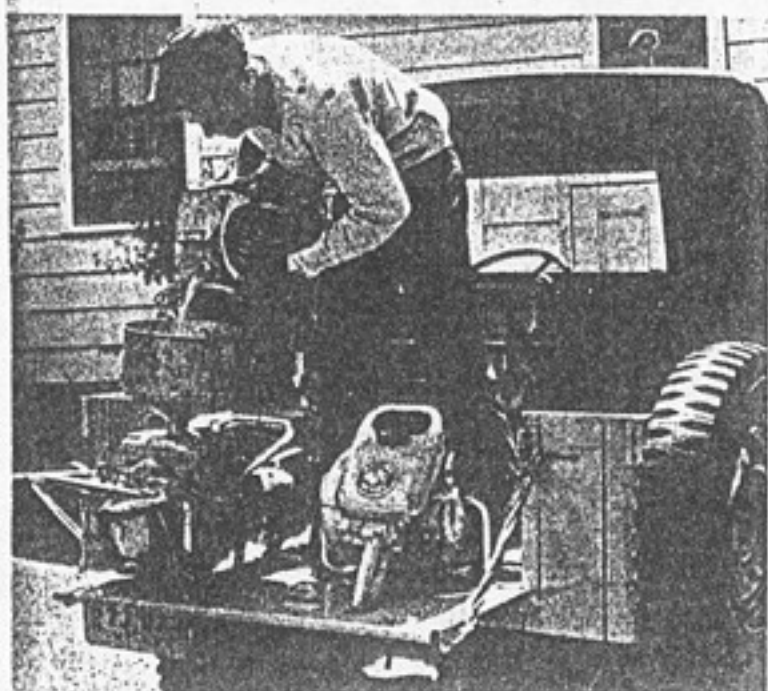
By H. W. Kellick

Mechanix Illustrated
January, 1952

WANT some trees cut down and sawed into firewood? Need top soil for your garden? How about underbrush to be cleared, bulldozing or snow removal? If your answer is "yes" then the fellow to see is Gene Lamb.

This 18-year-old youngster from Ossining, N. Y. offers a complete tractor service which provides, in addition to the above, plowing, harrowing, stone hauling, rough and final grading, mowing and hay removal. In fact, he'll solve almost any problem confronting a homeowner.

For providing these services, young Gene Lamb earns \$15,000 a year. He does no advertising, but word-to-mouth reports are swamping him with jobs. To save expenses, he uses his home as an office. His equipment, modern in every respect, is worth



Gene Lamb's office is a corner of the living room in his parents' Ossining, N. Y., home, top. Here he takes orders and plans their execution. A Willys Jeep furnishes him cheap transportation to and from jobs, carries his saws and other small tools.

The two-man power chain saw does the heavy work when the job is cutting down large trees and sawing them into logs or firewood, top. Mowing work is common during summer and fall. He also rakes hay, stacks it and hauls it away if desired.

\$7,000 and most of it is housed in a garage beside his home.

It all started three years ago. Gene was 15 then. He got a job as a helper to a landscaper, working after school and during summer vacations. While on the job, people pestered him to do odd jobs around their gardens. Gene merely shrugged off these requests. He was busy with his work and he had a regular weekly check coming in. It wasn't much, but the pay was steady and big enough for a teen-ager.

As people continued to ask Gene to do their odd jobs he began to reason, "If so many people want this work done, there must be money in it."

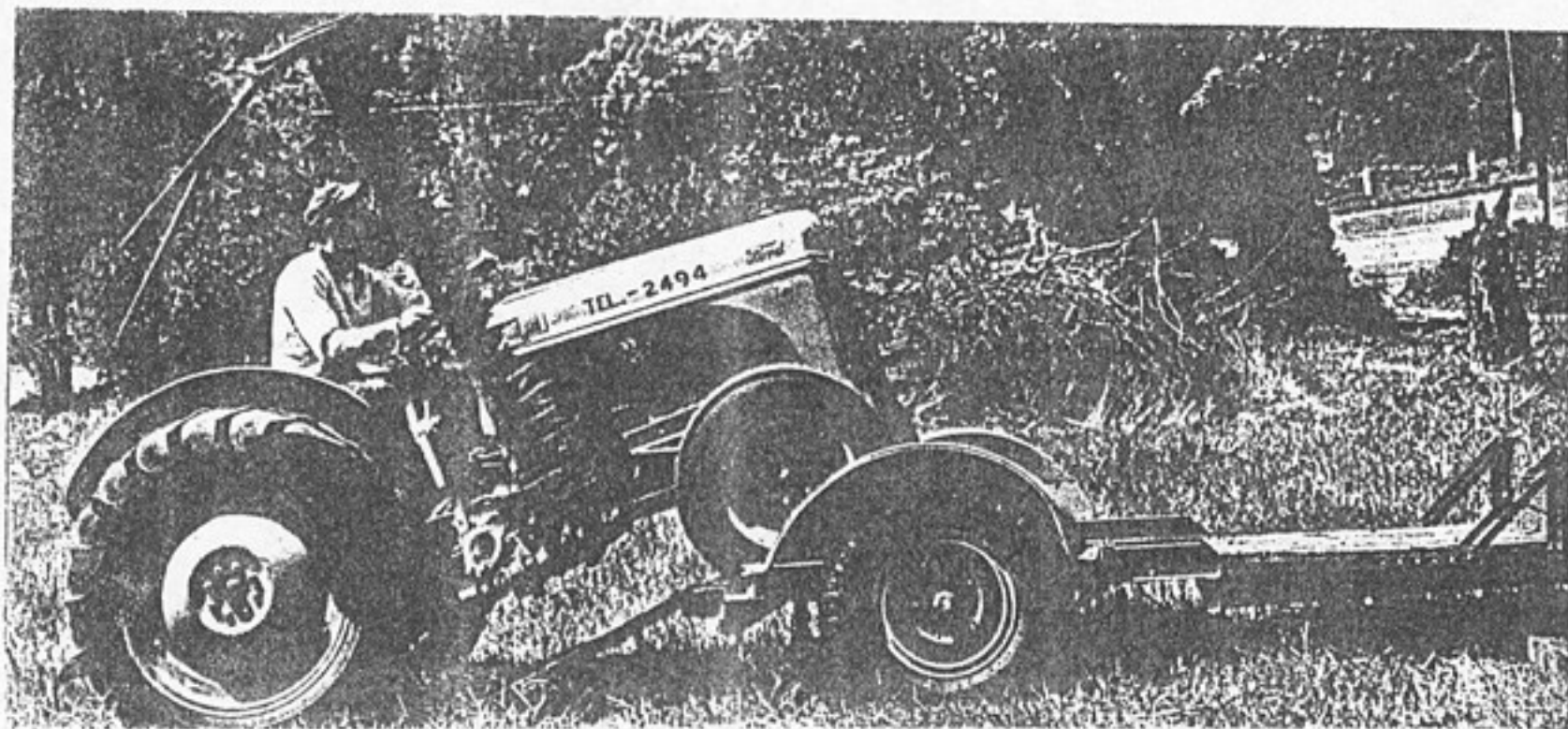
He saved up enough money for a down payment on a used Allis Chalmers tractor complete with mowing bar, disk harrow

and harrow attachments. To get experience with this outfit, he practiced on his home lot.

One day a neighbor saw him at work. Could he mow a field of hay for her, rake it and stack it in heaps? "Sure," replied the energetic kid. "I'll do it after school."

He worked four hours on the job and got \$20. Inspired by his first check earned in his own enterprise, Gene accepted some of the work neighbors had been trying to force on him.

While clearing underbrush and burning it, one customer asked Gene if he could cut down a couple of trees and saw them into required lengths. Gene never did this work before, but he could try the assignment anyway. He borrowed a chain saw from a friend and after some difficulty



Lamb loads his new Ford tractor on a trailer to move it to a distant job.

learning to master its power unit, Gene went out and did the job, earning \$30. The three trees took him less than an hour.

Using this capital, Gene immediately added a McCulloch one-man chain saw to his equipment. He managed small tree-cutting jobs with this tool and found a lot of customers.

Then a new problem arose. A man wanted some trees felled and cut into cord wood. To do the job, Gene needed a circular saw. He called on his hardware dealer and made a deal. "If I like this saw," said Gene, "I'll buy it." "Agreed!" said the dealer.

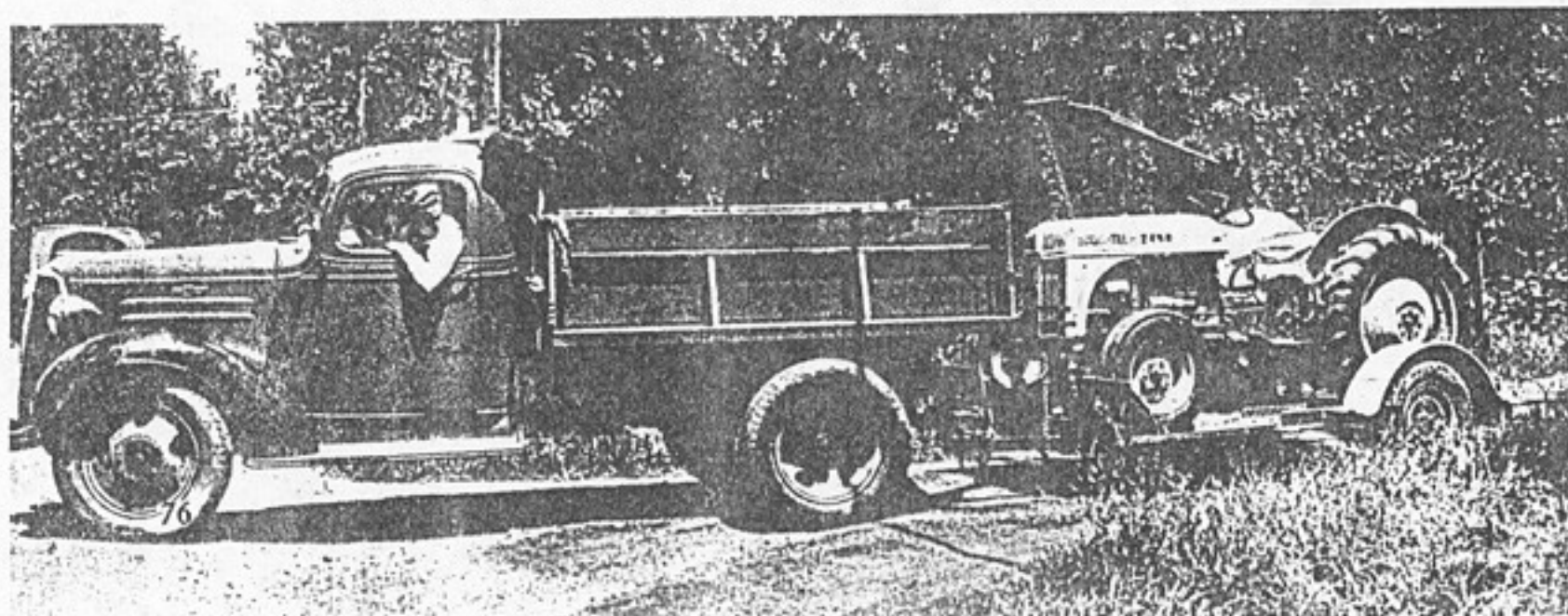
Gene cut six cords of wood with the borrowed saw attached to his tractor. Pleased with the way it worked, Gene kept his promise and bought it on time.

When a tornado whipped Westchester County, N. Y. into a frenzy in the fall of 1950, uprooting trees and leaving mountains of rubble in its wake, Gene Lamb

literally cleaned up. Armed with two chain saws (one a two-man job) his tractor and its attachments and a borrowed dump truck, Gene ploughed through tangled telephone wires, fished trees out of swimming pools, swung on branches like a Tarzan to cut broken limbs, and sawed up trees, some of them three feet in diameter. He hauled away big logs with his tractor and trailer at \$5 an hour. Then he cut the logs into cord wood on his own time and sold it for \$30 a cord. On some projects he hired a couple of men and charged the standard rate of \$10 an hour for rubble removal. If Gene had not been fully equipped to handle this emergency work, he never would have been able to take advantage of Nature's sudden blow.

Today, Gene has a complete assortment of tools and equipment. Recently he traded in his old tractor for a 1951 8N Ford. He added a front

His ton-and-a-half truck does the towing. Attachments are carried inside.



loader for digging up fill and top soil and a rear-end scoop so that he could do small excavation jobs like digging foundations for garages or digging out areas for lily ponds and small swimming pools. In addition, he bought a small Willys Jeep which he uses as cheap transportation to estimate prospective jobs and carry small tools.

When he heard that a fellow wanted to get rid of a Chevy ton-and-a-half dump truck, Gene snapped it up. With this he hauls around his trailer-tractor and sometimes stone, fill and top soil. Gene is constantly on the alert to line up dirt for fill. Many times he gets it for nothing for merely hauling it away. He sells it for \$1.25 a yard or \$6.25 a load.

Top soil is always in demand, its price varying with the quality of the soil. For the best clean top soil Gene gets \$7.50 a yard. Secondary top soil he sells for \$4 a yard. This, too, he often gets free.

How does Gene estimate his contracts? First he figures his necessary expenses such as liability-and-property damage insurance which is a must in his business. Then he adds 15 per cent to the base price to allow for wear and tear and possible breakdown of machinery.

For example, for mowing jobs, the rate is \$5 an hour. If a customer wants the hay raked and stacked in heaps, he charges \$2 extra per

man per hour. He gets a standard \$10 per load for removing hay.

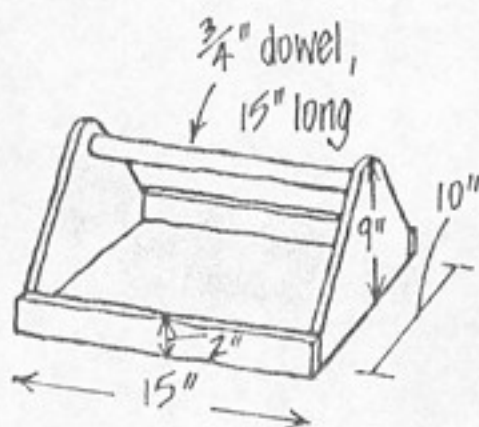
A few months ago, a Briarcliff, N. Y., landowner wanted 30 locust trees cut down, some to be cut into six-foot lengths for use as poles and others to be cut into firewood lengths.

Gene surveyed the trees. He found that they averaged about 10 inches in diameter and about 35 feet in height. Although locust trees often grow tall, they seldom have too many big branches. Gene took this factor into consideration on estimating his job. He arrived at a figure of \$10 per tree or \$300 for the contract. Gene got the job and it took him about three days to complete it.

Bigger trees, like a large oak or hickory which measures two to three feet in diameter and is loaded with many heavy branches costs a customer \$60 per tree.

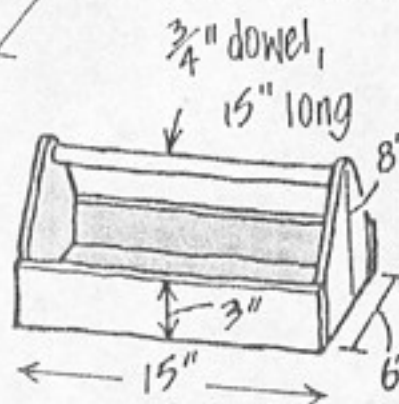
In the winter, he clears snow-choked driveways for \$5 per 100 to 150 feet. He often does as many as 10 in a day.

For a little fellow who never had any mechanical talent, Gene Lamb certainly is doing a job. He is shrewd and careful with his customers and when he takes on a contract, he delivers as agreed. And, as long as people own homes and plan to build more, Gene will continue to clean up in more ways than one. •



Garden carryall

Low sides (2 inches high) allow easy access to seedlings, tools, garden supplies. Box is big enough to carry pots up to 6 inches across



Under-the-sink tote box

Narrow, higher-sided box takes little storage space, is sized to hold hammer, screwdriver, pliers. Same design would be useful for holding several house-cleaning supplies

Easy-to-make household carryalls

SUNSET

MARCH, 1977

For carrying odds and ends, nothing has come along that's handier than the traditional carpenter's toolbox. The design is easy to adapt for lightweight carryalls that are useful around the house and garden.

For each of the carryalls shown here, you'll need just five pieces of 1/2-inch plywood plus doweling for the handle. Dowels are glued into drilled holes; they

could instead be attached with glue and lag screws or long woodscrews. You can follow the dimensions in the sketches, or adapt sizes to your own needs or materials on hand.

A few minutes of sanding prepares the surface for finishing and lessens the chance of splinters. You can seal the tote boxes with a clear finish or paint them as colorfully as you like. □



Extra Income FROM YOUR HOME WORKSHOP

POPULAR SCIENCE
JULY, 1941



By EDWIN M. LOVE

CAN the home workshop be a source of income? The answer is that it can. Thousands of one-man shops throughout the country afford full or part-time employment for their owners. Many have grown into two-, three-, and four-man shops, and even into small factories.

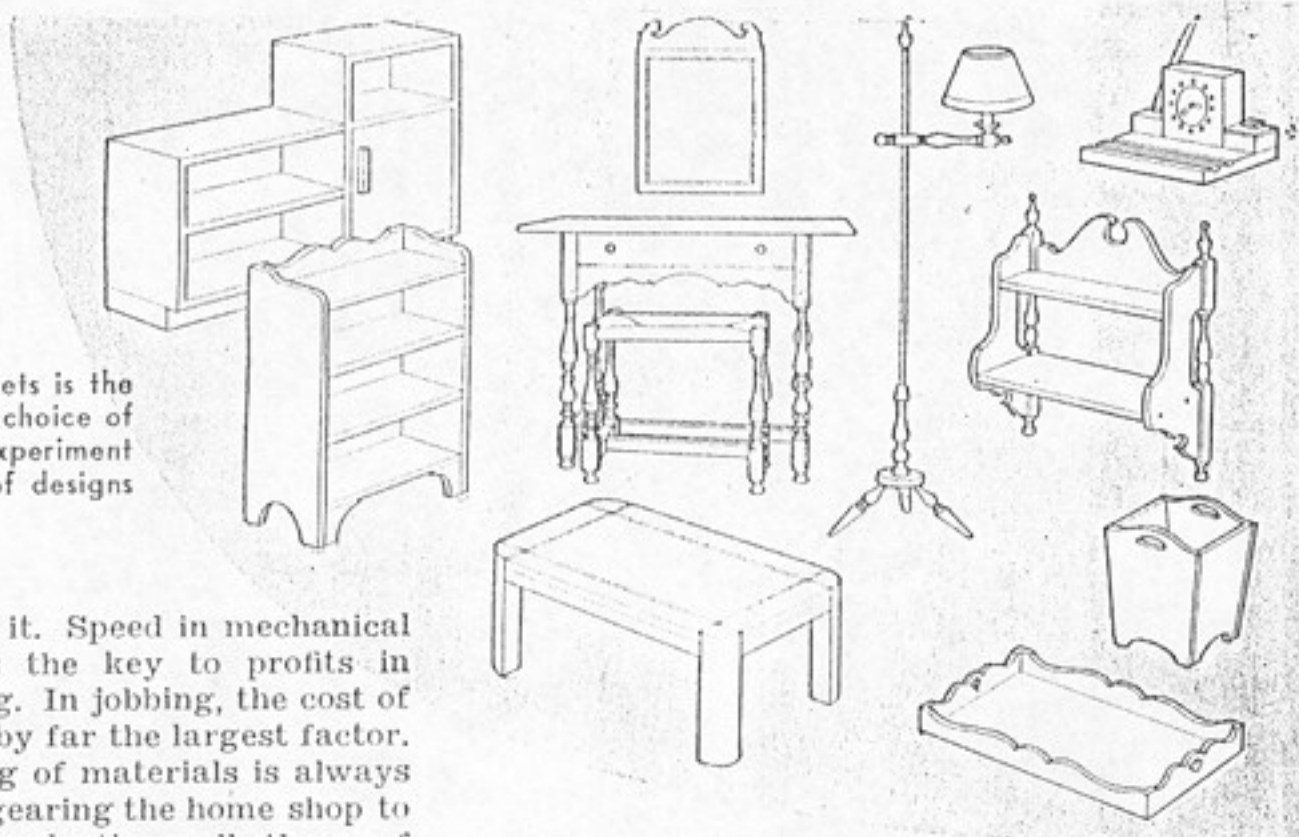
The amateur craftsman who has other regular employment and therefore has no desire to make a business of his hobby may, nevertheless, welcome extra money with which to purchase better tools, pay for materials for some pet project, or buy other articles not provided for in the family budget. There is besides a real satisfaction in creating a demand for one's individual products, and in turning out work for which others are glad to pay.

The problem of turning your skill to profit should be approached with ordinary common sense. It is wise to discard at the outset the idea of making a fortune overnight, or of gaining an "easy" job at home, and to face the fact that success will require hard work and intelligent enterprise, which can, however, be a source of keen satisfaction to the man building his own business.

Make a careful survey of your assets and liabilities. An honest appraisal of these will save you time and money. Study your skills, tastes, and inclinations. Will you be able to make the necessary personal contacts to sell your wares, or must this be left to some one else? Is your shop equipment adequate? Are there potential markets near by? Can you obtain a permit, if necessary, to operate in your present location?

Whatever field you propose to enter, you will find fairly definite prices already

A study of markets is the best guide to a choice of what to make. Experiment with a variety of designs



established in it. Speed in mechanical duplication is the key to profits in manufacturing. In jobbing, the cost of hand labor is by far the largest factor. Shrewd buying of materials is always essential. In gearing the home shop to commercial production, all three of these considerations enter.

Jobbing offers perhaps the safest start in the commercial field. Making built-in kitchen cabinets, linen closets, bookshelves, porch seats, trellises, and the like, lining closets with cedar, modernizing fireplaces—all come under this classification, and must usually be done on contract, at prices that will meet local competition. As lumber costs are readily estimated, the risk in bidding, even for the beginner, is not formidable. Even if the estimate proves to be too low, no direct money loss should result. To show a fair return for time spent, you must, of course, turn out creditable work as quickly as the average professional. Portable woodworking machines that can be set

up on the job or permanently installed on a trailer will go far toward helping you to meet competition.

Similar to jobbing is cabinetmaking—the building of new furniture and repairing and refinishing of old. Like other fields it has its drawbacks. Some customers may expect to buy especially designed and constructed pieces at the same price or less than stock factory models can be purchased for, but this is impossible. Handmade furniture cannot compete in price with that turned out on automatic lathes and with production machinery. However, some localities will afford a market for custom-made pieces at good prices.

Art products, gift wares, and the like are marketable in proportion to their novelty and quality. Few home shops can compete in the manufacture of ten-cent-store merchandise, but a cleverly designed article in a higher price range will often yield steady profits, for the public is eager to buy pieces that are truly out of the ordinary. Medium-priced products might be sold in moderate quantities, whereas high-priced or exclusive designs, if your community affords a market for such, might show a good profit even though requiring considerable time to make.

In this field good crafts-

8 Pointers for Making Money

- 1 Make an honest estimate of your skills, equipment, potential markets, and ability to get along with customers.
- 2 Start modestly, on a part-time basis. Do not invest your full time or much money until you have gained experience.
- 3 Keep trying until you succeed or are sure you are on the wrong track. Many businesses fail when close to success.
- 4 Try local markets first. If your products will not sell there, they probably will not sell elsewhere.
- 5 Diversify by making several items rather than only a single one, unless you control a patented product.
- 6 Study materials and their costs. Save by careful shopping, using scraps, and buying with other craftsmen in quantity.
- 7 Read books and magazines to familiarize yourself with production methods, new processes, and timesaving short cuts.
- 8 Keep a set of books showing income and expenditures.

manship and designing ability are essential. Display your work to as many friends as possible, urging them to criticize freely. Redesign with their comments in mind. Be cautious in accepting mere praise; there is little to be learned from it.

Ideas for craftwork abound in shop windows, in advertisements, in books and magazines. You have no right to make out-and-out copies of commercial products, many of which are patented or protected by design patents, but designs of the type published on the craftwork and woodworking pages of this magazine are yours to use without question. In any case, however, it is desirable to select or develop an individual style of design by which your products may be identified. Many projects published in this department from month to month, for example, may be used without substantial change by adapting the basic design to your individual style.

Simplification of an article is often necessary to make profit possible. Strive to reduce the number of parts and the number of necessary operations. Study the possibilities inherent in different materials. A piece commonplace when made of wood may be distinctive if made of plastic, and although the latter material is expensive, it eliminates the expense of painting. Designs in plastic may be equally attractive if made in wood or metal, and possibly more suited to home-workshop production.

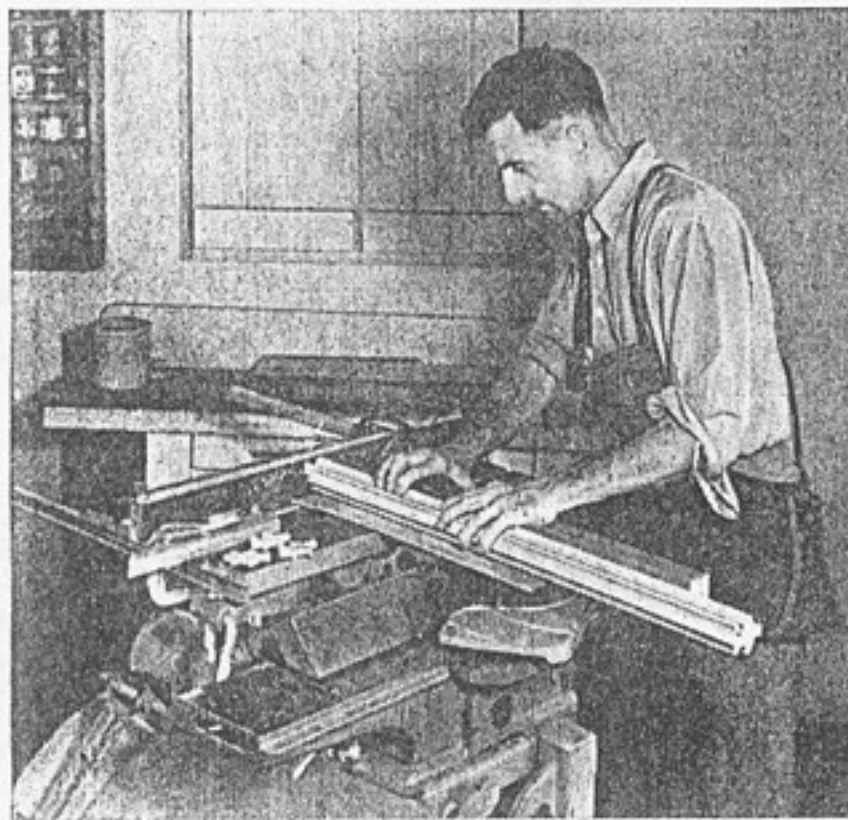
To make small, moderately priced articles in quantity, a knowledge of duplicating methods is essential. Script name pins, for example, can be cut five at a time from $\frac{1}{8}$ " plywood, the sheets being held together by

brads in the waste portions. Box jigs can also be used, both for sawing and drilling operations. Still another method is shown in two of the accompanying photographs. A length of stock is shaped to the desired profile, and thin sections cut off with a dado or crosscut blade on the circular saw. Study every such method you can find, with a view to applying it to your own production problems. The one just described, for example, is especially applicable to making place-card or price-tag holders, seasonal items such as Easter bunnies and chicks, animals for toy Noah's arks, and similar articles of simple design.

Whatever the products or services you have to offer, they must be brought to the attention of your prospective customers and kept before them. One way to begin, involving no risk, is to take orders from door to door, and make up only what you have sold. Shops will often sell goods on consignment, and it is only fair, if you offer your wares through dealers, not to sell directly to customers in the same territory. Friends and neighbors may be willing to help with word-of-mouth advertising, or you may find it profitable to send out circulars and post cards, or to advertise in local newspapers. If you live beside a well-traveled highway, an attractive sign stating what you have to offer may soon bring you more business than you are able to handle.

Just as the buyer usually gets exactly what he pays for, so the producer will, in the long run, obtain only the amount of business his goods merit. Permanent success is possible only by building a reputation for excellent work and fair dealing.

Profiles of simple items can be formed on a shaper, and pieces cut two at a time with a dado head





A MONEY-MAKING
idea

**I'M A
RABBIT
BUTCHER**

Everybody knows how fast bunnies multiply. Well, when you own a rabbit farm you find your income multiplies at just about the same time, too.

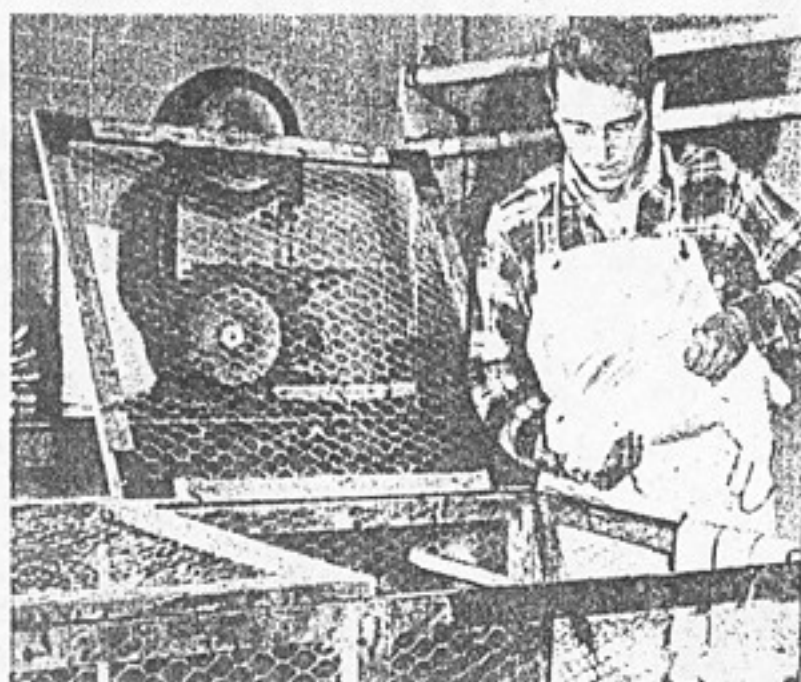
By Linwood Darling
as told to Art Henry

Mechanix Illustrated
May, 1952



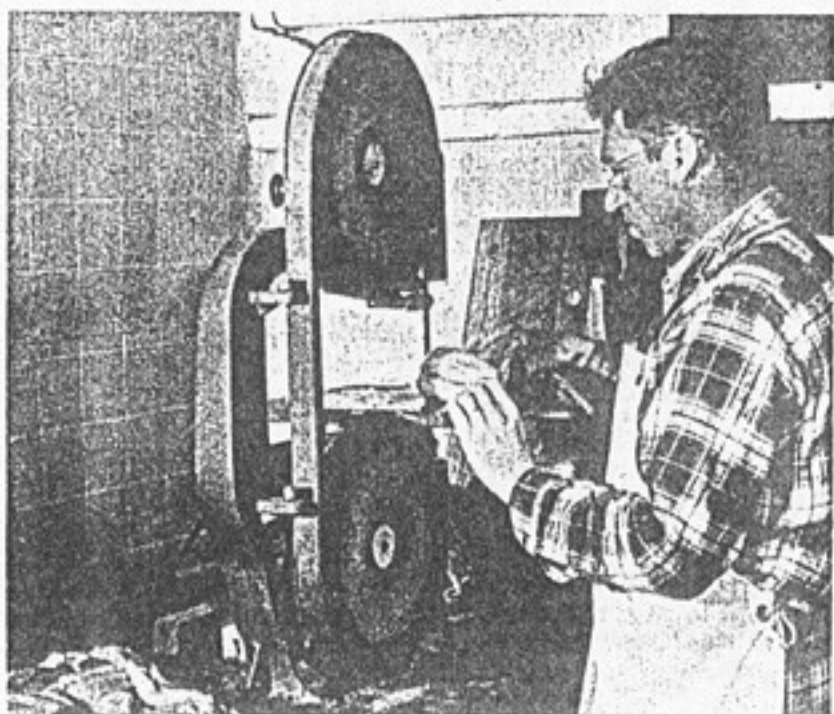
Triple tiers of hutches line the passageways of the main building. There are more than 1,000 of these hutches on the Darling Rabbit Farm.

Each carcass is cut into quarters on an ordinary bandsaw. The total slaughtering process, including packing, takes about 2½ minutes per rabbit.



Hutches in the slaughterhouse contain rabbits destined for the dinner table. Here, Darling removes a bunny preparatory to slaughtering it.

Each five-pound rabbit yields about 2½ pounds of meat—enough to fill one box. The containers are frozen and shipped to rabbit-meat markets.



I'M happy that rabbits came into my life—big ones and baby ones, common varieties and show winners, live ones and . . . yes, dead ones. These latter are putting me on easy street because I'm the only licensed rabbit butcher in the state of Maine.

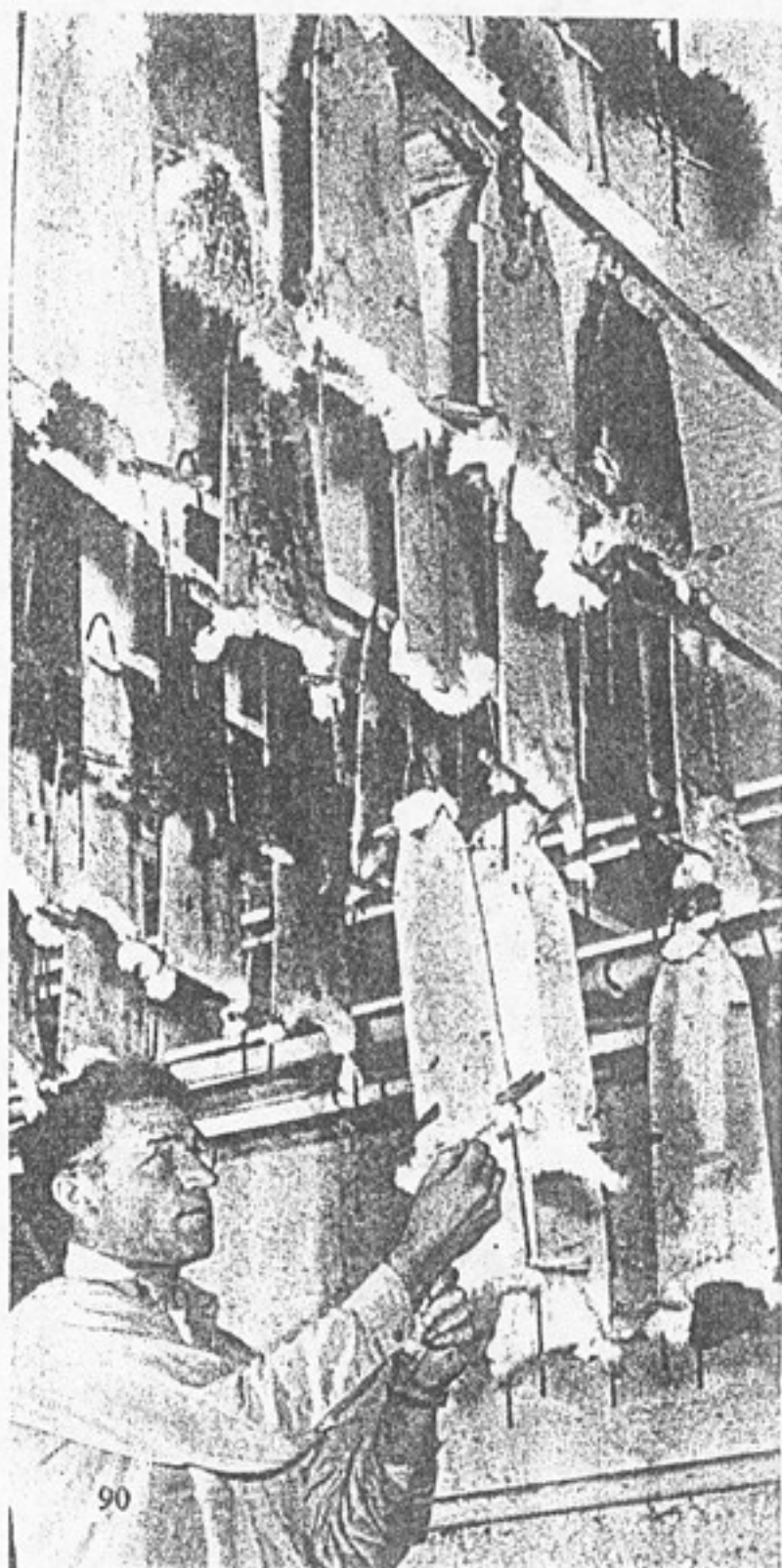
Five years ago I was a fairly successful chicken farmer in Cumberland Center. I scratched out a living by raising laying hens for hatching eggs and branched out into the broiler business. It added to my income and every little bit helped.

Then a puppy dog started me on the road to multiplying rabbits and my income. Here's how it all began. One day, early in 1947, a friend gave me a spaniel puppy. I liked the little scoundrel but he was a nuisance around the farm and didn't get along with my chickens. So, I traded him for a couple of female rabbits. My wife and I were fond of rabbit meat and I figured we could raise a few so we could have ourselves some hassenpfeffer every now and then.

A few! Now I have about 3,000 and I butcher from 250 to 300 every week. Those first two does had litters. I raised the young, slaughtered them, ate some myself and sold the rest to a neighbor. With this profit I bought six more does. These littered and the same thing happened. I found myself with

Bunny in center cost Darling about 75 cents to raise to maturity. After it is slaughtered it will yield the ten-cent skin, right, and about \$1.50 worth of edible meat, left.

After the rabbit skins are stretched, they are hung for a drying period before being sold to the Danbury felt-hat manufacturers. Note that pelts are turned inside-out to dry.



more rabbit meat than I could eat.

The local grocer was a friend of mine. "I'll buy some of it," he offered, "and sell it to my customers." I made \$23 on this first order.

The demand increased and soon people were banging not only at the door of the grocer but at my door, too, and I was supplying an average of 20 pounds of meat each. I was in business.

Rabbit-raising and slaughtering is one of the easiest and cleanest occupations—certainly much cleaner than chicken raising. For rabbits are careful about their toilet. Their meat is pure and wholesome. They breed rapidly and are cheap to raise. It costs about 75 cents' worth of commercial pellets to feed one to adulthood. I decided to forget my poultry and concentrate on the bunnies.

My home was the initial scene of operations but rabbits soon threatened to drive me out of it by sheer numbers. I launched my business officially with a couple of males, or bucks, and 15 does. Soon the rabbits were running all over the place and my hired man threatened to leave.

So, I built a small two-story building next to my house. In the cellar, I set up a slaughterhouse and used the first floor for pens. Last year, I converted a 100-foot barn into a modern breeding house filled with the latest conveniences for rabbit light housekeeping. It contains over 1,000 pens or hutches worth \$6,500.

For breeding, each hutch must be at least ten square feet in area so the doe can move around freely. She will produce about five litters each year and average eight babies or lambs to each litter. Therefore, one good doe will produce

about 40 rabbits each year. I use one buck for every ten does and rotate them, besides bringing in new strains to improve the herd and maintain production. At present I have about 600 breeders.

I also breed show stock and specialize in Champagne rabbits, a species with light gray fur which originated in France. In a recent Maine rabbit show, I entered 12 rabbits, competing against 225 entries, and placed ten of these, winning the first three prizes.

Rabbits which aren't kept for shows are slaughtered and the process is simple and extremely humane. First, the rabbit is killed quickly by snapping its neck. Then, it is decapitated, skinned and the carcass is placed in a huge vat of ice water. I slaughter from 100 to 200 at a time. Then, I take each carcass and cut it into quarters on an ordinary band-saw. Each four to five-pound rabbit averages 2½ pounds of meat. This is packed in a box for freezing in my deep-freeze and later shipment to market. The skin is turned inside-out to dry on a stretcher.

My rabbit business operates year-round. In August, when the market is slow, I freeze for the winter. Last year my two helpers and I slaughtered, skinned and sold over 15,000 rabbits. We realized over \$25,000.

For the meat, I get a wholesale price of

from 58 to 64 cents a pound. And since I've been in this business the price has always gone up, never down. My markets are mainly the stores in my neighborhood although I have just extended sales to Boston. This will keep me busy as a beaver.

In addition, I sell skins for ten cents each to men's felt-hat factories. And they want more than I can possibly supply.

Of course, I slaughter other breeders' rabbits besides my own. And seldom does a day go by that doesn't find the cages outside my shop filled with candidates for a dinner table. I process them, freeze them and deliver them to their owners for a moderate fee.

Just recently I slaughtered a customer's doe and didn't realize until too late that she was about to have young. The babies—all eight of them—are doing nicely. I bet I performed the first Caesarian in bunnydom.

If you should be passing my way, stop in. I have a bargain you might be interested in—real, live rabbits for 50 cents each. There's only one string attached. Last summer one of my large cages came apart and over three dozen bunnies escaped. They're living around the farm, underneath the house and barn. You can have them for 50 cents—but you'll have to catch them first. •



Shoeshine box gives you a comfortable footrest, stores all its equipment inside

Shoeshine boxes ...simple, sturdy

A simple shoeshine box is very handy to have at home. It keeps your polishing supplies together, lets you transport them easily to any room, and serves as a good support when polishing.

SUNSET

MARCH 1967

You can make one of scrap wood, in any convenient size. Shown above is an 8 by 14-inch box 11 inches high. It has a metal footrest, a piece of ½ by 1½-inch strap iron bent to shape in a vise, and it is covered with adhesive-backed corktone vinyl shelf liner.

The box below is about the same size except for its 6-inch height. It has a wooden footrest and varnished plywood exterior.



Here's a more compact version. On both, the footrests serve as carrying handles

A MONEY-MAKING

idea

Mail-order worms get individual attention from Miss Warner. She says their natural oils are good for her hands.

Mechanix Illustrated
SEPTEMBER, 1949

By George Laycock



She'll Sell You a Worm

Queen of America's earthworm farmers is Bernice Warner. Two million of these squirming creatures pass through her hands every year.

EARTHWORMS have gone commercial! You can now drop an order blank in the mail box and get a can of squirming worms by return mail. Worm farmers across the country are raising them in basements, barns, kitchens and corner cupboards.

Dean and queen of earthworm farmers is Bernice Warner who owns and operates the Ohio Earthworm Hatchery at Worthington, Ohio. Her worm enterprise covers two-thirds of an acre which also contains her house and garden. But you can raise a lot of worms on two-thirds of an acre. "We sell about two million worms a year," she says, "and still keep enough breeding stock to raise two million for the next year!"

How does a woman get into the worm-raising business? Well, Bernice Warner

quit her office job in 1938 determined to find a money-making business where she could be her own boss. When a friend suggested that she might raise earthworms she laughed the suggestion off.

Then she reconsidered. Through garden magazines she located other people interested in worms. Dr. George Sheffield Oliver, the country's leading worm scientist, was hoping to find somebody who would lavish the attention on worms that he thought they deserved. Miss Warner wasn't sure about the affection angle, but she *did* see a business with a future.

The doctor taught her the fine points of worm husbandry by mail. When he was convinced that she understood enough of the fundamentals, he sold her 20,000 mature breeders. From that start, she has built her entire business.

Selecting the mature worms from the backyard compost pits is the easy job, right. But counting out the day's earthworm orders is a tiring occupation, below, even with her nephew Dan to help.



When her underground boarders first arrived, Miss Warner made them at home in her basement. She visited local grocery stores and collected all the wooden grape boxes she could find. Each was filled with soil, manure and table scraps. She divided the worms, 500 to each box, moistened them and set them on shelves. Later she moved them into permanent quarters in the backyard. Her production line was under way.

The worms that Miss Warner purchased from Dr. Oliver were of the worm-world elite. Gardeners will no longer settle for any old worm. Before plunking down good inflation cash, they check into the worm's family tree. Some worm breeders sell only "domesticated" earthworms, insisting that these travel no more than two feet a year unless they become hungry or dry. "There are about 1600 species," says Miss Warner, "and the kind we have here are the best ones known for gardening."

Her own gardens reflect the quality of her worms. The strawberry patch is about the size of a large living room yet she picked 196 quarts last year. She explains, "I got the berries but the worms get the credit."

All the worms are raised in four pits. They're low wooden frame structures about ten feet square and filled with waste weeds, soil and barnyard manure.

Earthworms are nature's scavengers. They'll clean up a pile of garbage quicker than you can say "phew!" They eat anything they bump their blind little ends into—one worm eats his weight in soil and wastes every 24 hours. Within his body, enzymes act on the food and he deposits it back in the soil as fertile plant food.

In the process of eating his way toward China, the earthworm leaves a series of burrows that let valuable air and water into the soil. If you investigate the love life of an earthworm, you're in for a shock for worms are bisexual. Even though each worm is both man and wife, he-she must still meet and mate with another he-she to become fertile. Each worm will pass off an egg as a result. In 21 days the eggs hatch and release from two to 16 small worms. And they begin to eat almost immediately.

Miss Warner's average order is for 1500 worms at about a penny each. They're shipped in grape boxes surrounded by the mixture on which they feed. Warner earthworms have been shipped to every state in the Union and to several foreign countries. One order from South Africa was sent by air freight and the shipping charges exceeded the value of the worms.

During the day, Miss Warner's worm herdsman hauls boxes of uncounted worms to the basement. In the evening she and her mother count them one at a time until the orders are packed and ready to be shipped the following morning. It takes a half hour to count 1500 worms. About 600 worms make a good handful but generally the number is difficult to estimate.

Miss Warner points out that raising worms to sell is not a business to jump into. Start on a small scale in your spare time. If you decide there's a future in it for you, then go at it in earnest.

Breeding stock sells for about a penny each. If you start with 1500 worms, your only investment

will be the \$15 for the worms. You can house them in old grape boxes which your grocer will either give you or sell for a dime. Fill the box with one third each of soil, manure and peat moss. Occasionally mix in table scraps to keep the worms fat and happy.

You may have trouble with your neighbors, though. "I've been raising worms here for 10 years but some of my neighbors still think it's unsanitary. Actually, it's more sanitary than garbage cans with lids ajar for cats and dogs to drag the contents through the alleys. We throw our garbage right on the worm pits and they turn it into clean, odorless humus within a few hours."

When you have enough worms to offer for sale, invest in a small advertisement in a garden magazine. Most of the earthworm farmers list their stock in the pages of Organic Gardening Magazine, published in Emmaus, Pa.

Advertising will be your only expense other than mailing costs. Your biggest contribution is your time. Your income will vary in proportion to the amount of time you can give.

Reports on the value of earthworms to the gardener are sometimes conflicting. But there's a California farmer who claims that with the help of extra worms he grew carrots so large that one could have filled four 1¼-

pound cans. The same gardener claims to have raised four-pound parsnips.

Miss Warner has discovered an added advantage which should interest women. The handling of worms is a good beauty treatment for her hands. "Worms give off a natural oil that is excellent for the skin," she claims. "Research men are trying to figure out how to collect this oil or make it. When they do, someone will have a good money-making idea."

While Bernice Warner has brought fame to worms, the worms have done much for her, too. She's been in New York a number of times with them and recalls the time she appeared on the radio show *Hobby Lobby*.

In an effort to pep up his show, the master of ceremonies asked, "Miss Warner, did you ever hear a worm turn?" The question had hardly passed his lips when Miss Warner snapped, "Yes, many times. I've also heard them talk to themselves. They make a sound like running water."

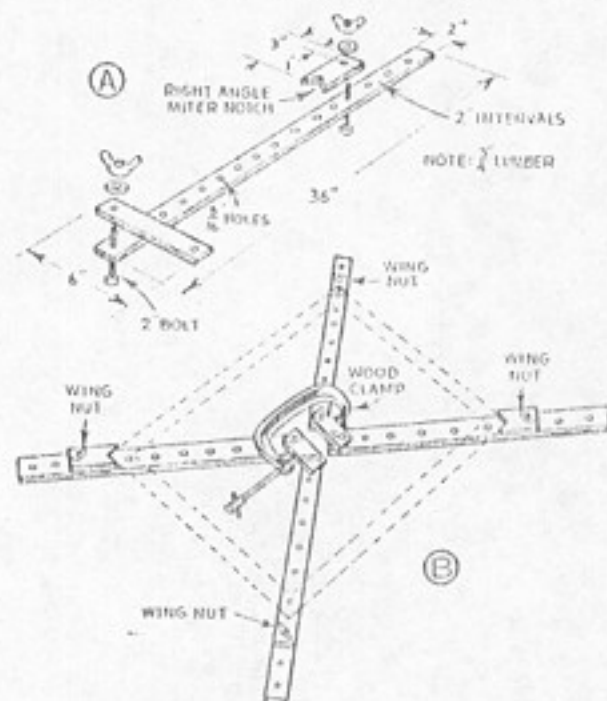
Thereupon, she poured a few worms onto a sheet of thin paper and let millions of people in the radio audience hear them.

Now, she insists her earthworms are the only worms which ever broadcast on a nationwide hookup. And she's undoubtedly right! •

How to Glue Picture Frames

• Here is a practical cramp to hold picture frames together while waiting for glue to dry. Cut four 3 ft. long and four 6 in. long strips from ¾x2 in. scrap lumber. Notch two short pieces as in diagram (A) and drill a 5/16 in. hole 2 in. from notched end. Cut these pieces in center, thus making four corner pieces. Drill remaining two short cross pieces as shown. Next, mark off four long strips in 2 in. intervals and drill with 5/16 in. drill. Assemble as in (A) with ½x2 in. long bolts with wing nuts and washers, leaving all units free swinging.

To cramp frame, adjust to size and take up

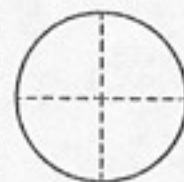


slack with a wood clamp. Nail or drill and peg frame while in cramp. Lay entire construction

on level area so frame will not warp. This cramp takes frames from 8 in. to 5½ ft. Two rubber-headed tacks in bottom of frame will keep frame away from wall and prevent unsightly dust marks.—KENNETH D. OLSEN.

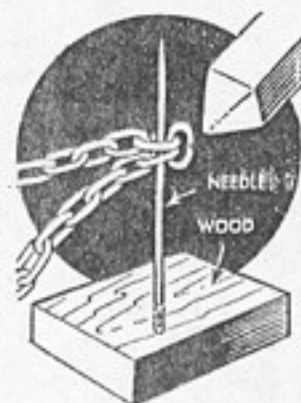
Folded Paper Locates Centers

TO FIND the center of a piece of round stock, make a tracing of the work on thin paper. Holding the paper up to the light, fold it twice as shown. Then unfold the paper, place it carefully on the work, and prick-punch the intersection of the fold lines.



Fine Jewelry Chain Is Soldered On Needle Fixture

A needle stuck vertically into a wooden block will provide a fixture for holding fine jewelry chains to solder a broken link. Slip the two links adjoining the broken one over the needle as indicated. This will hold the broken link in position for soldering with a small soldering iron. In some cases, it may be better to support the needle at an angle or in a horizontal position. You can do this by gripping the fixture in a small vise. Size of the needle to use will depend on the size of the chain links. These should not slide more than halfway down the length of the needle.—Ed Pelczar.



Beat High Costs With SPARE-TIME JOBS

Mechanix Illustrated January, 1953



Short of money?
There are lots of
ways you can
increase your income
with your hobby
or a job on the side.

By Harry Kursh

A FEW years ago, Ed Robinson worked in an advertising agency in New York. His wife, Carolyn, had a department store job. Both were reasonably content. But just for kicks they bought themselves an inexpensive home-stead near Norwalk, Conn., about an hour by train to the big city, and went in for part time farming. It wasn't easy, but it was fun.

In fact, they loved it so much that they decided to write a booklet which they called The Have-More Plan, all about how part-time farming succeeded in giving them a richer, fuller life. The booklet went over with a smash. Their mail was flooded with orders from all over the country and even from such far-off places as India.



Jim Rodgers is a busy man. He's a student at Long Island University, President of the Student Council, studies when he can while working in a lunchette, above left. He poses with his family, above.

It was only the beginning. They began writing and selling more booklets. Before long they found themselves in a full-time booklet business and the self-appointed leaders in a crusade to get more people interested in part-time farming. Ed and Carolyn left their jobs and opened The Country Book Store in Noroton, Conn. According to the latest figures, more than half a million of Ed Robinson's original plan booklets have been sold at \$1 per.

Ed and Carolyn are not alone. Many astonishing success stories originating in part-time occupations are being quietly written all over the country.

Last year, Marianne Roney, a 22-year-old Phi Beta Kappa, was working for her Ph.D. in medieval literature at Columbia University in New York. Meanwhile, Marianne took a part-time job writing phonograph record album notes for Bartok Records, Inc. The job gave Marianne an unique idea. Why not combine literature with the phonograph? She got hold of another 22-year-old Phi Beta Kappa, Barbara Cohen, and together they organized Caedmon Record Co. for the purpose of selling discs featuring the works of famous present-day novelists, poets and playwrights. That was only a few months ago.

They didn't even have an office. Yet they managed, through initiative and enthusiasm, to get such celebrated names as Tennessee Williams, Thomas Mann and Laurence Olivier to read from their own works for recordings. The New York Times

described the first four releases of Caedmon records as direct hits. The orders are still pouring in from nearly every state in the Union.

Now Marianne and Barbara operate their own studio in New York's swank office district at 460 Fourth Avenue and they have national distribution for their products. "We're well on the road to real success," says Marianne.

In this generation, the idea of working on a part-time job has spread like a brush fire. Today, according to the latest report of the government's Bureau of Census, close to 10,000,000 men and women are engaged in part-time occupations.



Mrs. Alice Daly of San Francisco sells unusual Christmas cards. She makes figures, scenes from scrap materials, photographs them in color.



But he has a full-time job, too, as an elevator operator. He plans to become a social worker.

It goes without saying that untold millions are using their spare time to meet soaring living costs and to augment the family income, maybe to pay for a new car or television set. When a New Jersey reporter recently found a college professor working nights as a part-time counterman, the story landed on page one. When a Long Island high school principal was killed in an accident while driving a truck on the final day of his part-time summer job last year, that tragedy made page one, too.

But overlooked by headlines is the simple fact that many are using part-time jobs to aim for new fortunes. The census survey, for instance, showed that at least 7,900,000

of the 10,000,000 part-time workers in the country were on such jobs for more reasons than economic need.

Just before World War II, Richard S. Perkin was a Wall Street broker. An associate of his, Charles W. Elmer, was a court stenographer. But between them they had a lot in common. They were keenly interested in amateur astronomy. For such a precise hobby there are many problems.

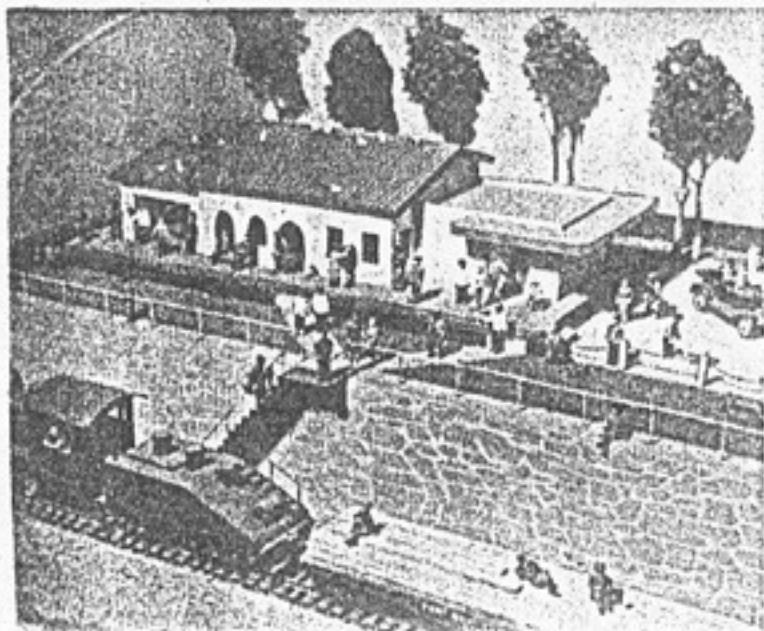
Perkin and Elmer decided their fellow hobbyists could use a little help with optical equipment. They started a small, part-time shop. Today, Perkin-Elmer Corp. with more than 350 employees is one of the leading firms of its kind in the nation. Still growing, it has mushroomed out into the commercial instrument field in which they are the largest producers of infra-red spectrometers, instruments designed to analyze complex chemical substances. A Perkin-Elmer panoramic camera recently gained world-wide fame for its ability to photograph the entire State of Pennsylvania in less than a day. Elmer retired three years ago. Perkin, now 46, is president of the company.

Of course, most people don't get rich overnight as the result of a part-time job. Nevertheless, if you have any kind of spare time, take a good look around you. It might be a forgotten hobby or some way in which you solved a problem with your own hands or brains that could turn out to be your own way of beating the high cost of living.

Take the case of Mrs. Louise Cohen of Cheviot Hill, Calif. She was giving a party in her house not long ago and wanted special match boxes in keeping with the tone of her party decorations. She scoured every store but was unable to find anything she liked.

Finally she made her own by covering

Charles Weston of Healdsburg, Calif., creates tiny people for miniature HO-gauge railroad layouts. They are perfectly balanced, made to a scale of $3\frac{1}{2}$ mm to a foot, and complete in every detail even to the gold stripes on uniforms of conductors, brakemen. There are 40 models, hand painted.



ordinary match box covers with colorful wallpaper. It delighted her friends. So, Mrs. Cohen sat down to make more. It soon became a hobby. Last year, she started selling them. She's already sold more than 15,000 of them through some of the nation's top-rate department stores in Chicago, New York, Los Angeles, Pittsburgh and Boston.

In Baldwin, Mich., R. W. Overholser was making furniture out of weirdly shaped tree roots in his spare time. He found that it attracted much interest. He collected his products under one roof and now puts on an exhibit which he calls Shrine of the Pines. He pockets extra cash by charging an admission fee.

A few years ago, Mrs. G. B. Warren was surprised on her birthday with the gift of a tiny, table-model kiln. She tried her hand at making small ceramic objects for family, friends and neighbors. A lot of women wanted to know how she did it. In a little while, Mrs. Warren found herself teaching her hobby to a small group of women. In the basement of her Springfield, Ill., home Mrs. Warren is now in business, running year-round classes for women eager to learn a new hobby or to make artistic objects for their own homes. She already has had over 400 students.

The case of Robert H. Swackhamer in Long Valley, N. J., was a little different. He wasn't too pleased with his job as an aircraft company sales manager. It kept him away from his family too often. One day, two years ago, while watching his wife painstakingly braiding a rug, he decided that a small, home-type machine ought to do it faster.

Robert, the handy type, set to work de-

Brooklyn Dodgers' Jackie Robinson has an office at Rockefeller Plaza, New York, after signing NBC contract as Community Activities Director.



signing such a machine. He even got a patent on it. Now in a rented two-story structure not far from home, Mr. and Mrs. Swackhamer tend to a thriving business in braided rugs. You can find Robert home most of the time these days.

Maybe the neighbors of Dallas Smith in his home town of Indianapolis thought it was odd for a man who was an Indiana State Police aviator to be cutting up pieces of fiberboard in his spare time. Yet that's what Smith was doing about three years ago when he toyed with the idea of making easy-to-move living room chairs for muscle-sore housewives. The idea came

Several years ago Jesse Newman of Nags Head, N. C., started collecting sea shells as a hobby. Now he supplies collectors all over the world.



Detroit High School Principal Clinton Galbraith made only \$3,175 yearly, earned extra money by working 14 hours daily in summer hot dog stand.





Abe Patterson of Pembroke, Ontario, was a lumberman till he found he could whittle. Now he's so far behind in orders he never will catch up.



In Saco, Maine, lives Perc Sylvester, retired rubber worker. He made a fishing lure, it worked, now he sells thousands of all kinds yearly.

when he visited friends in a new home and had to sit around on fragile crates because their furniture hadn't yet arrived. He succeeded in making his unique fiberboard chairs so strong that they hardly could be distinguished from the real thing, once disguised under slip covers. Naturally, he's no longer a pilot cop. He's too busy shipping his chairs all over the country at \$20 and \$30 each, depending on style.

Experts in the field of vocational guidance agree that one of the most vital and most overlooked factors in spare-time occupations is the opportunity it provides to get new ideas. In their language, it's called

vocational exploration.

Says Dr. Emily T. Burr, director of the nationally known Guidance Bureau, Inc.: "The value of human relations and the broadening of your experiences come out amazingly well through part-time work."

Lawrence A. Appley, for instance, once wanted to teach English and speech. He started by working his way through Ohio Wesleyan University with part-time jobs. Subsequently, he was a washing-machine salesman, a short-order cook, a motorcycle cop, a truck driver, a high school debate coach and a streetcar conductor.

On the surface these jobs had nothing in common, but they gave young Appley a keen interest in people and in the subject of human relations. He scrapped his teaching plans and aimed for a new career in personnel relations. Eventually he became vice president in charge of personnel for Vick Chemical Company and the giant Montgomery Ward Company. He was appointed deputy Chairman of the War Manpower Commission. Today, he is president and chief executive of the influential American Management Association, one of the nation's top business firms.

Joseph Gilman wanted to be an accountant, but when his small gift-shop business didn't pan out, he took a part-time job as a process server, handing out court summonses for lawyers. He got a fee for each one he managed to deliver. "I made \$20 the first day on the job," Gilman recalls, "and it was such a fabulous sum for those times that I decided to look further into the matter."



Lawrence Appley, see text, President of American Management Association, displays the 1952 Human Relations Award recently given to him.

He did. Now he directs the Gilman Service Bureau heading a force of more than 30 process servers and one of the largest agencies of its type in the United States. "Not only that," says Gilman, "I also learned so much about investigative work that I soon qualified for one of the toughest things to get in New York State—a private detective's license."

The one big question, of course, is how to get a part-time job.

Naturally, you can advertise for one or watch the help-wanted columns in newspapers and this magazine. In the larger cities and towns, though, there are some employment agencies that specialize in getting part-time help. These usually can be found under the employment agency category of classified telephone books alongside such typical terms as *temporary* and *part time*.

A good idea, anyway, say many experts, is to make the rounds of various employment agencies, tell them what you're interested in and fill out an application blank, specifying part-time work only. It should not cost you anything. Most legitimate agencies don't charge application fees. They get a commission when they get you the job. Sometimes employers, eager to get part-time workers, pay the commission themselves.

A lot, however, depends on your own ingenuity. There are many industries that normally rely on part-time workers to meet an important part of their personnel needs. Take Joseph Gilman's process serving business, for example. In any state where the law requires that a summons must be handed over in person, you're bound to find an agency or law firm just begging for honest and reliable men to serve summonses for them at anywhere for 75 cents to \$1 for each one handed out successfully. Men with cars and who know their way around can earn a day's pay in a few hours.

Look around. Inquire. Keep your eyes and ears open. Let people know you're interested in part-time work. Many movie houses and theatres, for example, are only open part of the day and hire part-time employees almost exclusively.

If you have a car, a real estate agency might hire you to take prospective customers out to look at homes on weekends. This is especially true for new building developments. It could be a good way of learning real-estate salesmanship.

If you have a skill with office machines or like to add figures, look into banks and various financial institutions. Many do their book-keeping and record checking at night. They need part-time help because it's hard to get regular employees to work nights.

Department stores are in constant need of sales clerks, demonstrators, office help and stockroom workers, especially around such holiday times as Christmas and Easter seasons or during special sales.

More and more restaurants and cafeterias are delivering coffee and sandwiches to office workers. They need part-time help especially between 10 a.m. and 2 p.m. It might be an opportunity to get past reception desks you've never been able to crack before.

If you should be eyeing the possibility of a complete occupational change, however, don't just do it by hearsay or on the advice of well-meaning friends. Investigate the field thoroughly. If you don't want to go in too much for vocational exploration through part-time jobs, an excellent source of help for you is the Bureau of Labor Statistics which has been putting out a pile of booklets giving the requirements and predicting futures in a wide range of occupations. These are based on intensive investigations and are written by experts.

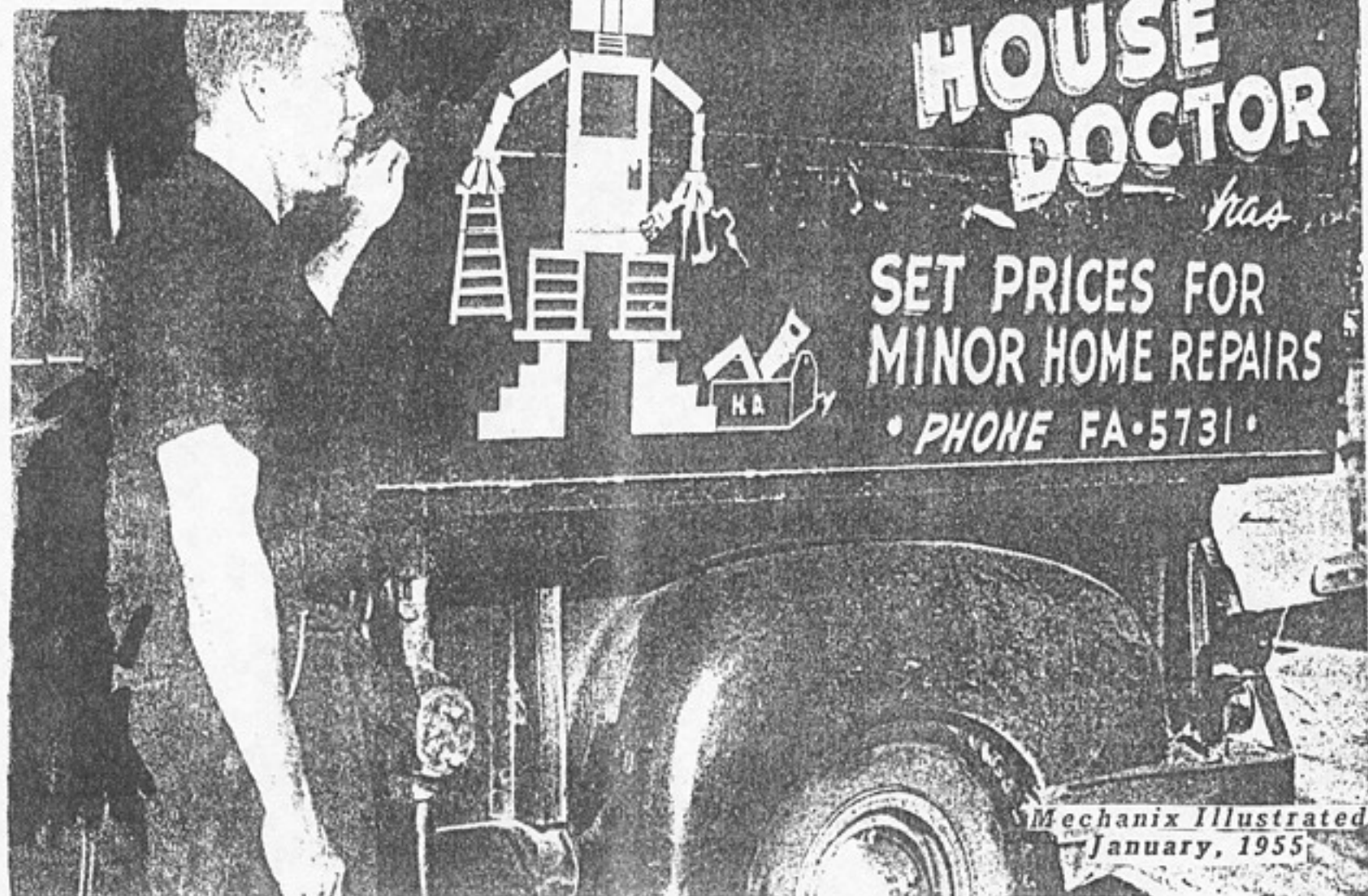
Let's say, for example, that you're a radio repairman and you think that right now things don't look too good for that field. You want to switch to the spectacular electronics field. Write to the Bureau of Labor Statistics in care of the Department of Commerce, Washington 25, D. C. and ask for their Employment Outlook booklet in the radio-electronics field. They'll tell you if they have one, how much it costs and you can order it from the Government Printing Office in Washington.

But let's say you're giving thought to starting a part-time business of your own. Maybe you want to make concrete blocks for homeowners. Write to Bureau of Foreign and Domestic Commerce, also in the Department of Commerce, Washington, and ask for the booklet, *Will Making Concrete Blocks Pay In Your Community?* You'd get one, too, odd as it sounds. This bureau has been preparing a long list of booklets. They're all under the general heading, *Establishing and Operating a Business*. If you want a free complete list of businesses they have booklets on, just drop a postcard to them. The most expensive booklet on the current list costs \$1; most run under 50 cents.

Whether it's to go into your own spare-time business, or to get a part-time job, whether it's for extra cash to beat the high cost of living or a chance to explore new vocations, there's virtually no end to the list of possibilities on what you can do to make your spare time pay. You may not get rich or be a success in 24 hours, but you can be sure you'll have a lot of fun trying and make money besides. •

A MONEY-MAKING

idea



Walters and his original handmade truck which he still uses to carry tools, supplies.

He Cashes In On Headaches

"Doc" Walters of Fort Worth, Texas, built a flourishing business keeping "patients" in a fine state of repair.

By Robert M. Hyatt

THIS is the story of George E. Walters, Fort Worth, Texas, businessman, who turned a major profit-killer into a substantial money-maker, escaped a crop of ulcers, and became a "House Doctor."

For nearly 17 years building and moving houses had been Walters' mainstay. But a steadily increasing portion of his business was making small home repairs. As any contractor will tell you, there's little money—often real losses—in these minor repairs. You have to pull a craftsman off his daily shift, send him across town to figure a job, then send him on to a supplier for materials. Frequently he spends several hours fiddling around on a one-hour job. And someone has to pay his travel time.

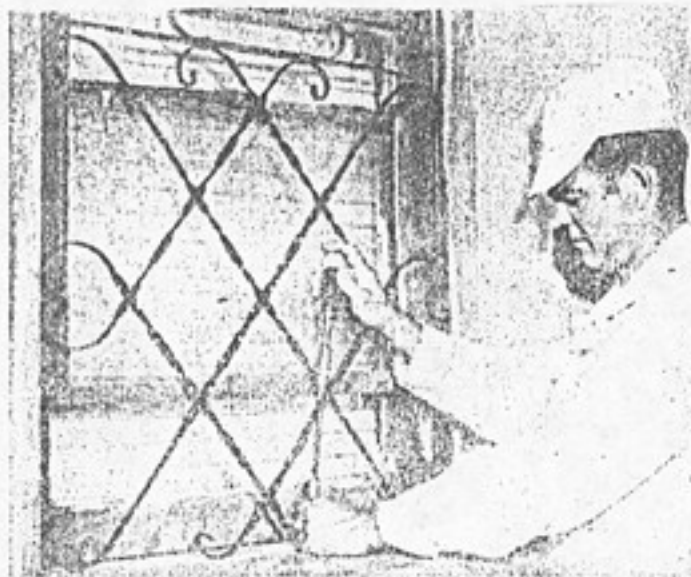
Like many other home builders, Walters felt he had to take care of these trivial calls for goodwill reasons and the occasional worthwhile contracts that developed from them.

But the red ink was drowning the black,

Mechanix Illustrated
January, 1955

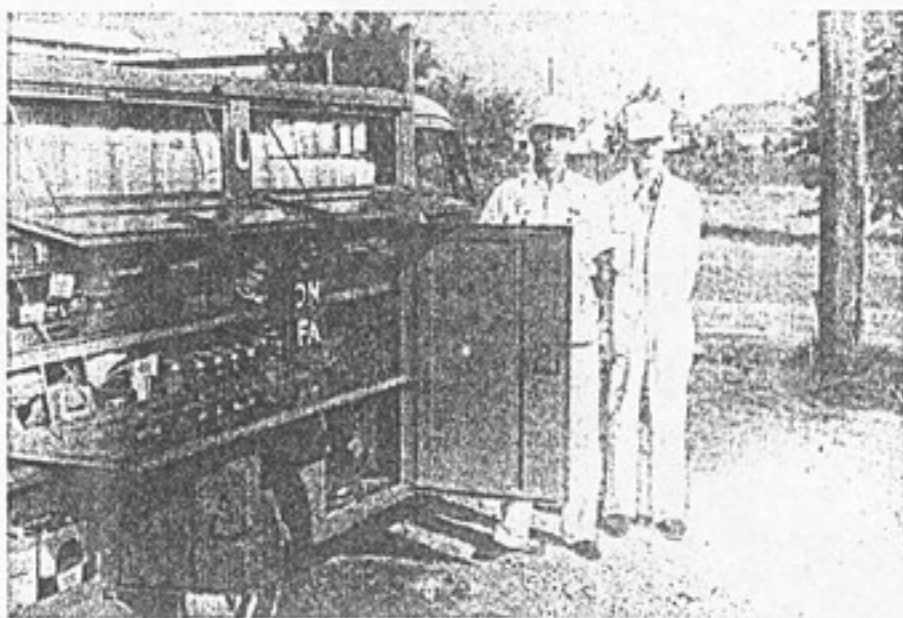


Brand-new factory job, above, was delivered to House Doctor last year. Craftsmen Preston Terry, left below, and George Moore, pose alongside special cabinet-like sides containing materials they use to repair homes. One side holds paint and supplies, the other tools, hardware, gadgets.



George Pearson, one of six "specialists" Walters hired, puts burglar guard on customer's window.

Hanging screen doors is one of most frequent chores. Ray Williams performs the "operation."



ledger-wise. In mid-1953, with small jobs multiplying and good contracts dwindling alarmingly, Walters reached a crisis. In order to stay in business, he would have to discontinue all minor home repairs and bend every effort toward getting new building and moving contracts. The feasibility of the plan was questionable. Stopping the home calls would jeopardize old customer friendships—and possible future jobs. And Walters doubted that he could compete with the ever-growing number of low-bidders in the building field and still maintain his fine reputation.

There was one alternative: get into something new. He had been collecting data on the popular "do-it-yourself" craze. Why not open a school to teach men these crafts? Tentative feelers indicated that there were plenty of potential students.

But his wife halted his teaching plan by pointing out that he ought to cash in on the very market that was strangling his business—small home repairs. She had a

sound argument. Almost every home had need of someone to make occasional repairs, she insisted. There were broken window glass and sash cords to replace, roof leaks to patch, sagging doors to fix, and any number of dog kennels, cabinets and other items to build around the house.

"Who knows more about such things than you?" she asked her skeptical spouse. And, as a final damper to his teaching aspirations, she added, "Don't think that every home has a do-it-yourself bug. There's more likely to be a golf maniac!"

Walters had to agree. Once sold on the idea, he quickly came up with a solution to the home repair problem. The first need was to make home calls speedily, with all the tools and supplies necessary to complete a job on one trip. In his spare time he and a couple of men built a special body on a light truck chassis. They packed into its cabinet-like sides some \$3,000 worth of supplies and tools. They called it the "House Doctor," designed an appropriate

Note that the prices are from 1955.
Revise upwards for today's costs.

DOORS

Refit dragging doors.....		\$ 2.00 each
Refit by-pass sliding doors.....		\$ 3.00 each
Refit sliding doors into wall.....		\$ 5.00 each
Refit swinging door.....		\$ 3.50 each
Rescreen door.....	2'8"x6'8"	\$ 3.50 galv.
	3'0"x7'0"	\$ 4.75 aluminum or copper
		\$ 3.75 galv.
		\$ 5.00 aluminum or copper
		\$ 5.00
Weatherstrip door, bronze with felt.....	Up to 3'0"	\$ 3.00 with hardware included
Hang screen doors.....	Up to 3'0"	\$ 4.00 with butt hinges incl.
Hang old doors that have lock.....	Up to 3'0"	\$ 6.50 with hinges and lock
Hang old doors and install mortise lock.....	Up to 3'0"	\$10.00 with hinges and lock
Hang old doors and install outside cylinder lock.....	Up to 3'0"	\$ 7.50 with hinges and lock
Hang old doors and install passage lock.....	Up to 3'0"	\$ 4.00 installed
Screen door grille.....		\$ 1.00 per door
Door steps.....		\$ 1.00 per coat per side
Paint screen door.....		\$15.00 with hardware
We furnish—install screen door, paint one coat.....		\$ 2.10 outside
Install threshold.....	Up to 3'0"	\$ 1.75 inside

WINDOWS

Replace window glass in windows and doors.....	12"x12"	\$ 1.50
	18"x18"	\$ 2.50
	24"x24"	\$ 3.60
	30"x30" single strength	\$ 5.00
	36"x36" double strength	\$ 9.50
Refit stuck or misfit window.....		\$ 1.75
Install window lock.....		\$ 1.25
Install window lifts.....		\$ 1.25
Reputty windows.....	12-light window	\$.30 pane
	casement window	\$.40 pane
	Sash, single pane	\$.07 foot
	Up to 2'8"x5'2"	\$ 3.00 galv.
Rescreen window.....		\$ 4.75 aluminum or copper
		\$ 5.00
Weatherstrip window, bronze with felt.....	Up to 3'0" wide	\$ 4.00 installed
Window grille—for burglar guards.....		\$ 1.50 each cord
Install sash cord, per cord.....		

GARAGE DOORS

Refit garage door.....	\$10.00 per door
Hang.....	\$15.00 per opening

SHELVING

Install, furnish brackets, lumber, 1 coat paint.....	\$ 1.00 per lineal foot
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CLOTHES POLES

Furnish—Cement, dig hole.....	\$ 5.00
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Mailing out prospectuses with the prices for specific jobs, like the one above, is strongly recommended by Walters to any would-be House Doctor.

emblem, and inserted an ad in the local paper. That was early in December, 1953.

Walters and his job estimator, Roy Miller, set up a list of flat prices for jobs, beginning at \$2 (for re-fitting a sagging door) on up to \$15 (for hanging a garage door). Gloria Walters, George's wife and secretary, worked out a simple card file system and began making phone calls to both old customers and those they hoped to acquire.

The newspaper ad began paying off; the office phone started ringing. The handmade truck was out from eight to six; the two-man crew couldn't handle all the business. Newsmen called on Walters, shot pictures and gave him a brief write-up. He was in. He soon became "Doc" Walters to Fort Worth residents, each of whom seemed to have a job or two for the House Doctor.

After that first hectic week, the newspaper ad was dropped. Doc hired six men

and ordered a brand-new special truck (cost \$2,700), which was delivered early in June. Since then, both trucks have been on the run constantly. Walters' rapidly growing business has resulted mostly from word-of-mouth advertising, which is mighty good if you can get it!

The House Doctor's calls average eight a day, at \$25 each. "That's more than most medical doctors average," grins Doc Walters. "And look how long they have to go to college!"

Two hundred dollars a day isn't an accurate average, Walters hastens to explain. "Nearly half of our customers find additional work for the man on the job—sometimes a whole lot of it."

Here are some examples of extra work that developed from calls in a single month:

A homeowner called the House Doctor on a \$5 job. When

that was finished, she discovered that several windows were stuck, others needed new sash cords and weights. This work comes rather high, since time rather than material is involved. When the windows were finished, the homeowner ordered a large back porch torn down and rose trellises built. To top it off, she had her house painted.

When the House Doctor figured the bill, it came to slightly over \$1,300! And it was paid without a qualm.

Another call initially figured about \$30—for patching plaster cracks and repairing some shaky back steps. It rained the day the job was finished and showed up some roof leaks. A new roof, plus several other major operations, brought the total to \$900.

Such instances are not rare; they are increasing to the extent where, Walters says, he'll have to order four more trucks between now and the first of the year. And, of course, extra men to handle them.

The versatile House Doctor has removed bats from attics, squirrels from air-conditioning ducts, and rats from basements. He's netted fly-away parakeets from rafters and rescued cats from lofty perches.

Here is another branch of the business that is piling up calls for the doctor, although frequently interrupting his sleep. Fort Worth, like other cities, has its share of house-breakers. Burglarized homes usually have a slit screen, broken window glass, maybe a jimmied door lock. Victims call the police first, then the House Doctor to repair the damage.

"Several times," Walters told me, "our truck arrived before the police."

From an insignificant beginning a few months ago, and a one-shot newspaper announcement, Walters' unique idea quickly caught the fancy of Fort Worth residents. It also interested a promoter, who visualized rich future rewards. He proposed to Walters that they throw in together and set up a nationally advertised franchise deal whereby they would offer to interested parties the House Doctor plan in a package.

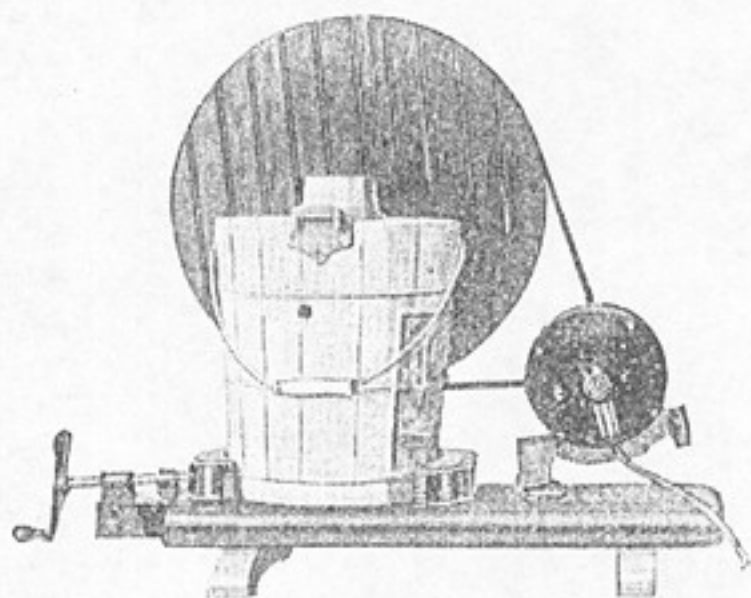
Walters turned the proposition down, not because it lacked merit, but because he is satisfied to confine his service to Fort Worth residents exclusively. As he points out, "There's probably a man or two in each city who will want to become a House Doctor. He should do so in his own way."

Walters offers a few tips to that man. He should have a good basic knowledge of the various crafts that go into household repairs, such as carpentry, painting, glazing, plumbing, etc. He should have a good assortment of tools. Men who have caught the do-it-yourself fever are excellent candidates for House Doctors. A neat truck is a must. Naturally, established building contractors are ready to handle House Doctor operations.

Looking back on the tottering state of his business a few months ago, George Walters can afford to smile. "Becoming a House Doctor not only pulled me out of a deadly slump, it gave me a new initiative in a field I know well and I'm making plenty of money."

Doc Walters is perfectly satisfied. He has originated an idea that is good for business, good for employment, and good for the homeowner. As a topper, he adds, "The nice thing about being a good House Doctor is—you never lose a patient!" •

Electric Motor Belted to Hand Freezer Makes Ice Cream While You Loaf



How elements of electric freezer are arranged. Flywheel may be attached to shaft with pipe flange or by strap iron embedded in wood. Hinging motor keeps belt at right tension.

HOME-MADE ice cream is lots of fun but freezing it is another story. With this stunt in operation, however, you can make cream while you loaf.

The freezer itself is an ordinary hand freezer, with the handle removed and a 17½ in. wooden wheel fitted to the shaft. The wheel is made up of two thicknesses of any ½" material placed at right angles and nailed. They may be attached to the freezer shaft with pipe flanges. A V is cut in the edge for the belting.

Any old ¼ h.p. motor will do for a power plant. Hinged to the base as shown in the photo, the motor will keep the belt always at correct tension. The clamps which hold the freezer on the base are made up of discarded parts of old bar clamps, but any arrangement can be used which will hold the can solid. About 100 r.p.m. is the proper speed for the flywheel for a quick and tasty freezing job.

Popular Mechanics 1944

Making Money with a

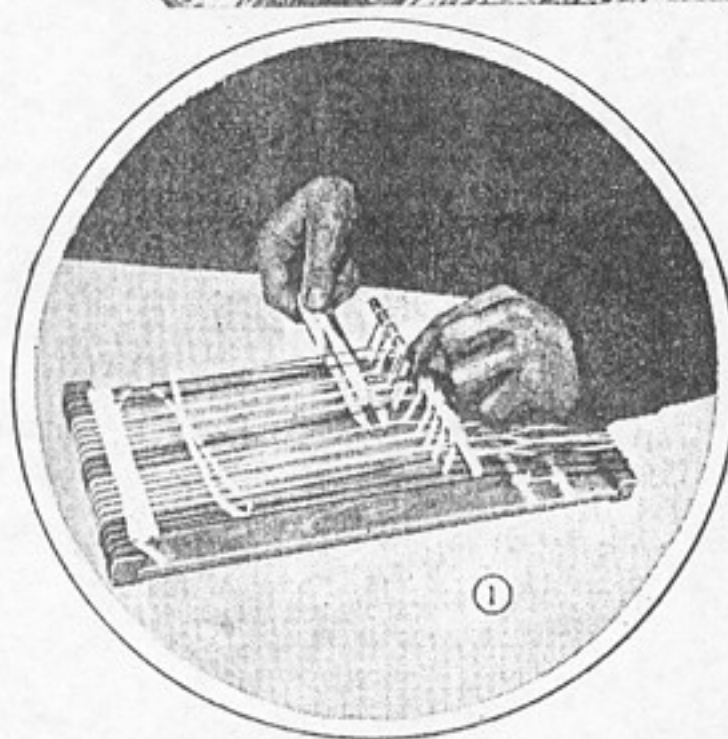
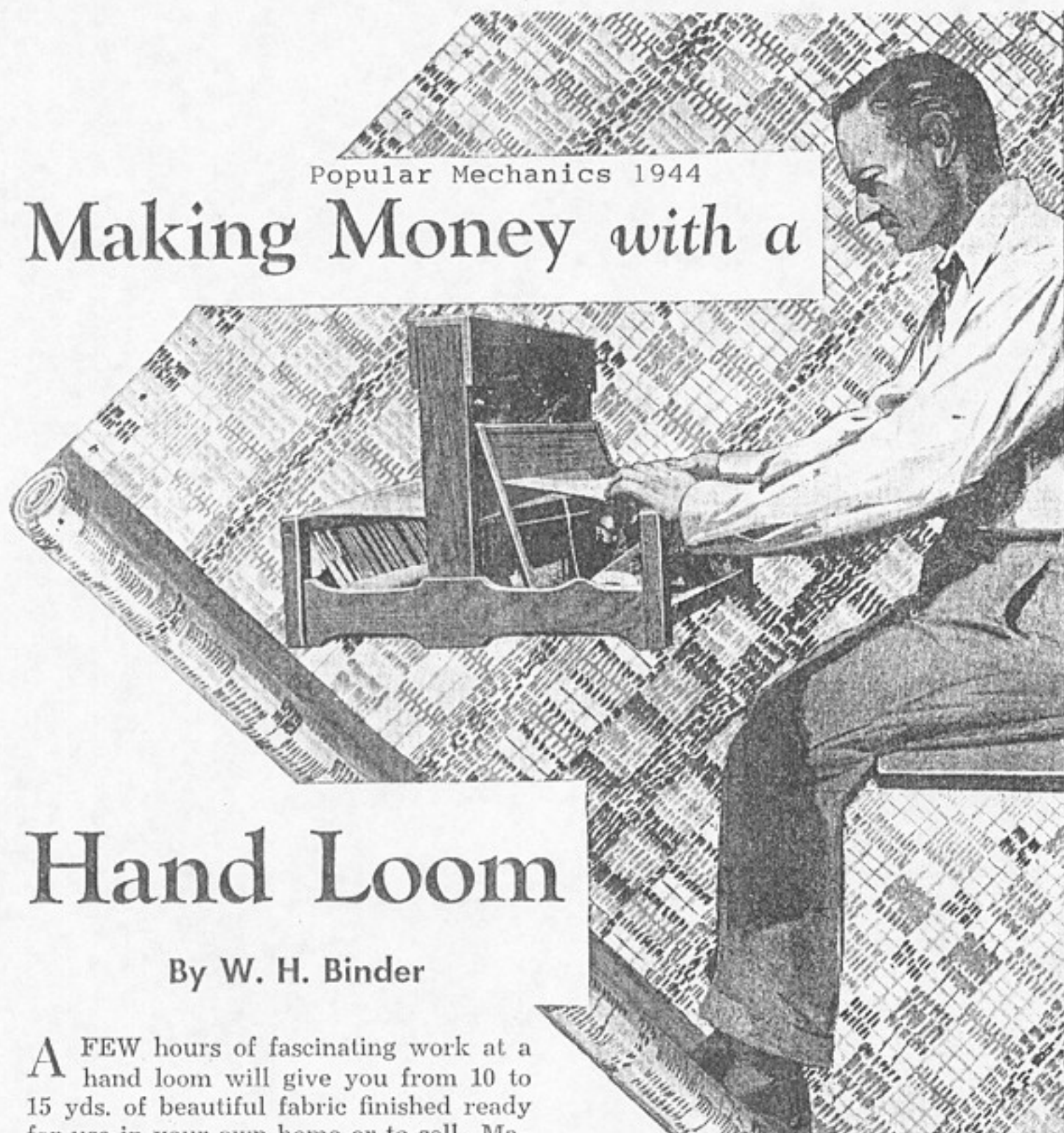
Hand Loom

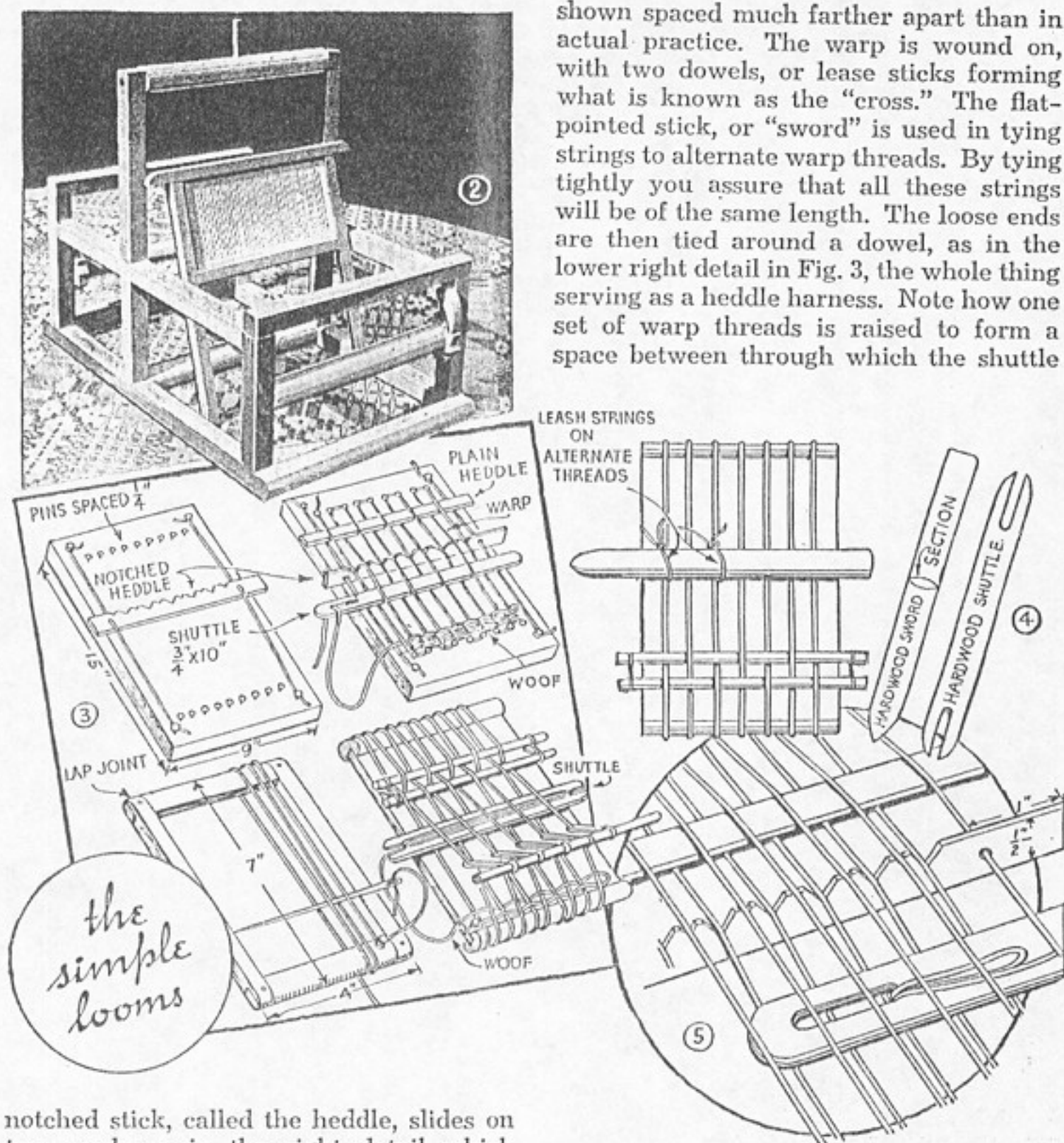
By W. H. Binder

A FEW hours of fascinating work at a hand loom will give you from 10 to 15 yds. of beautiful fabric finished ready for use in your own home or to sell. Materials for the finest work are inexpensive and can be obtained most anywhere.

Simple Looms: Of the several types of looms suitable for home work, the simplest consists of a board or frame, Figs. 1 and 3, around which threads are wound evenly, the cross threads woven in with a darning needle or a shuttle, Fig. 4. Although the principle of weaving is the same on all looms, some have more elaborate devices than others to speed up the work. In brief, weaving is simply the process of drawing transverse threads, known as the "woof" or "weft," through alternate lengthwise threads known as the "warp."

Top details in Fig. 3 show another type of loom made on a flat board. A row of pins near the ends hold the warp, and a





notched stick, called the heddle, slides on two cords as in the right detail which shows the loom complete with weaving in process and with the plain and notched heddles in position. The heddle, although it varies in form, serves the same function in every loom, that of separating alternate warp threads so that the shuttles can be passed between them. In Fig. 5 you'll see how the small notches of the heddle hold one set of warp threads higher than those in the deeper notches, permitting the shuttle to pass between.

The hand loom shown at the left in Fig. 4, is especially easy to operate, and once threaded, work can be done with reasonable speed. Of course, the threads are

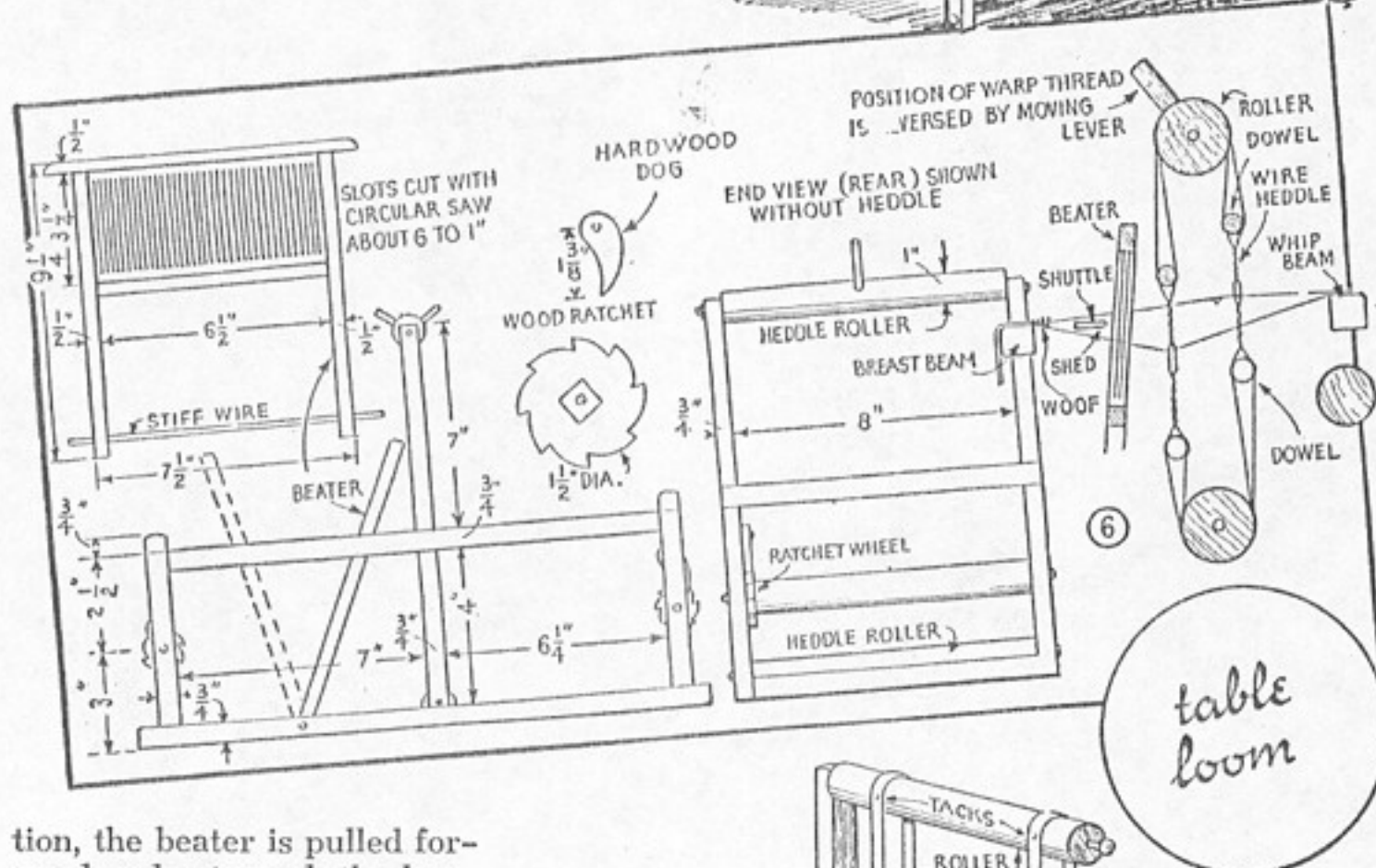
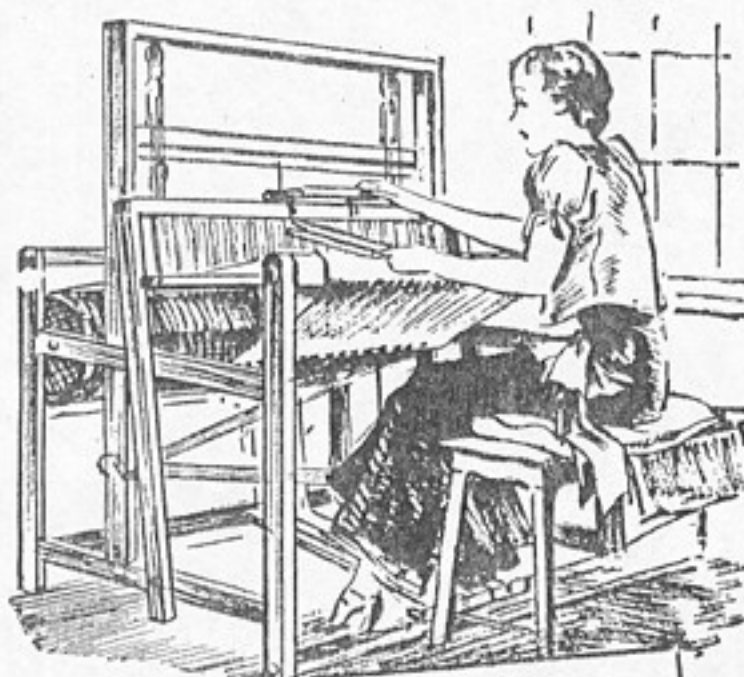
shown spaced much farther apart than in actual practice. The warp is wound on, with two dowels, or lease sticks forming what is known as the "cross." The flat-pointed stick, or "sword" is used in tying strings to alternate warp threads. By tying tightly you assure that all these strings will be of the same length. The loose ends are then tied around a dowel, as in the lower right detail in Fig. 3, the whole thing serving as a heddle harness. Note how one set of warp threads is raised to form a space between through which the shuttle

is passed. This space is known as the "shed." The shuttle passes from right to left through the first shed, then the heddle harness is lifted and the shuttle is passed from left to right through the second shed, the process repeating in the same order.

Table Looms: The table loom is a somewhat more elaborate affair as you will see from Figs. 2, 6 and 7. It consists of a framework of $\frac{3}{4}$ by $\frac{3}{4}$ -in. hardwood with two rollers or beams carrying the heddles, which are moved with a lever as in Fig. 6. Then there is the slotted panel, called the reed, and a frame in which it is installed. The unit is known as the "beater" and is

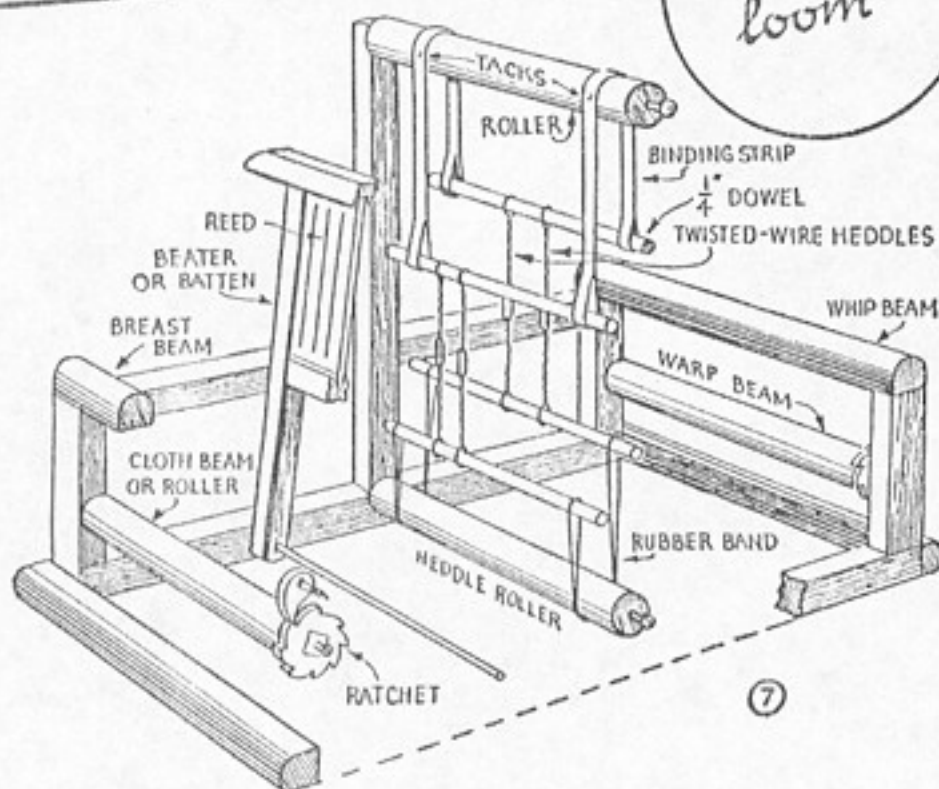
for the purpose of beating the woof threads tight after the shuttle has passed through the shed.

Structural details are shown in Figs. 6 and 7. Rollers with ratchets are provided at each end of the frame, one for winding up the cloth as it is woven, the other to unwind the warp threads. To show the construction more clearly only two wire heddles are shown on each harness, whereas in practice several dozen may be used, depending upon the width of the cloth to be woven and the size of threads. The right-hand detail of Fig. 6 illustrates the action of the heddles. After the shuttle has passed through the shed in one direc-

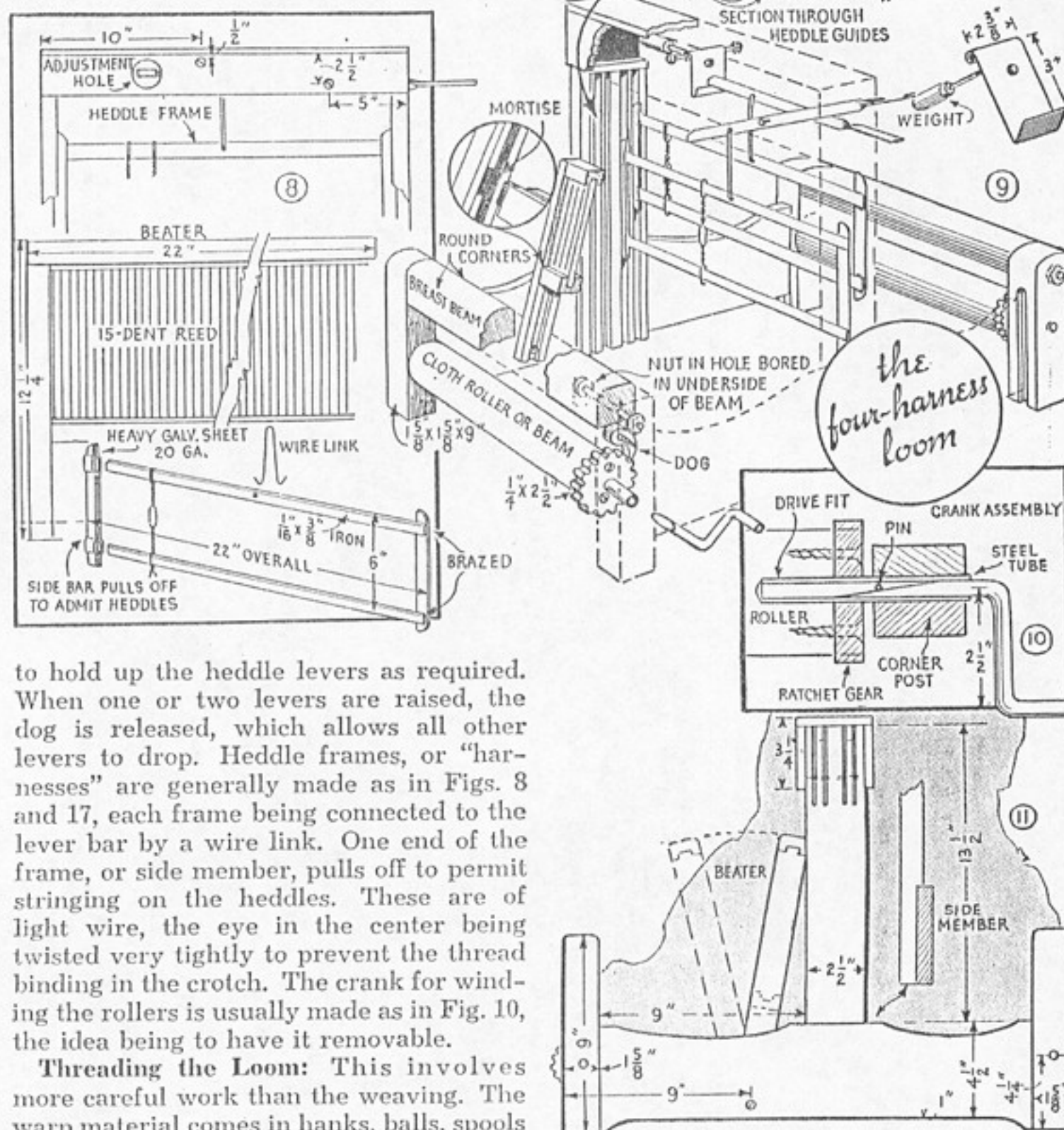


tion, the beater is pulled forward and returned, the handle on the top roller is moved back to reverse the position of the warp and the shuttle comes back through the shed again.

“Four-harness” Loom: Structurally this loom is essentially the same as that just described, except that it is fitted with four sets of heddles instead of two and is capable of weaving more intricate patterns. It should be kept in mind that hand looms are fitted with as high as sixteen heddles, but these can be



handled only by an experienced operator. Figs. 8 to 11 show how this type is made and how it works. Note that the heddles slide in grooves in the uprights and are moved up and down by levers at the right side of the frame. The "15-dent" reed, Fig. 8, is satisfactory for ordinary work. The term "15-dent" usually refers to the number of strips or wires per inch. In ordinary pattern weaving two heddles are moved at a time, that is, they work in pairs, but not always the same pair. The combination to use is determined by the "pattern draft" which is purchased along with the material for weaving. A sheet-metal dog, Fig. 9, is installed in the top of the frame



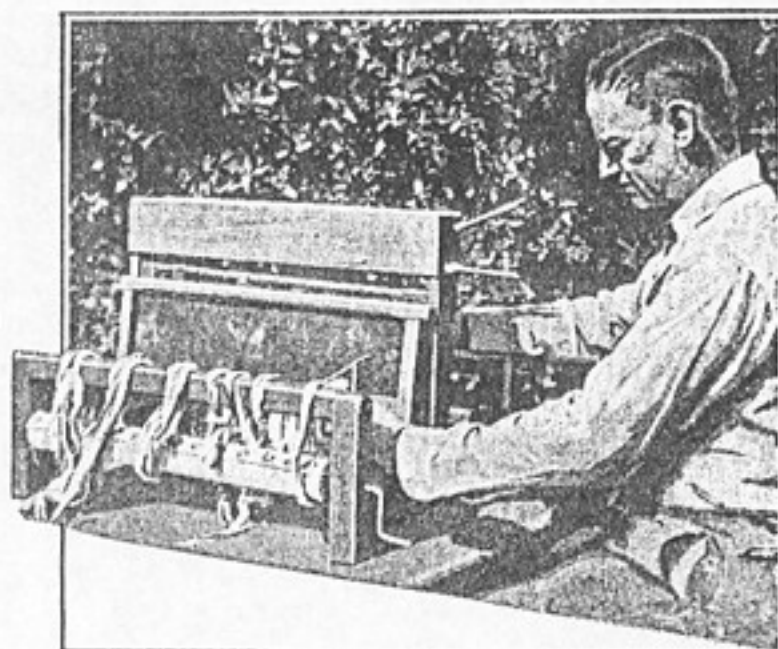
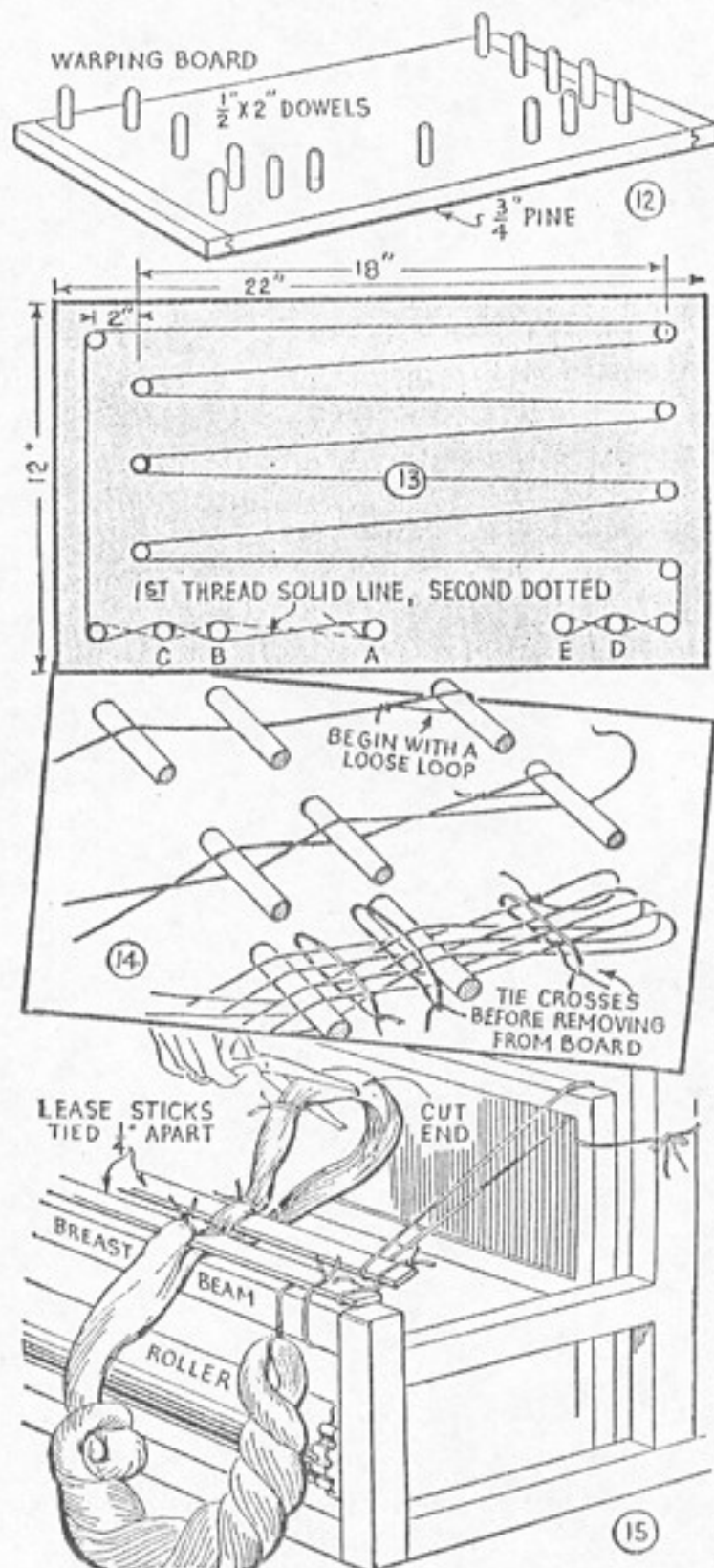
to hold up the heddle levers as required. When one or two levers are raised, the dog is released, which allows all other levers to drop. Heddle frames, or "harnesses" are generally made as in Figs. 8 and 17, each frame being connected to the lever bar by a wire link. One end of the frame, or side member, pulls off to permit stringing on the heddles. These are of light wire, the eye in the center being twisted very tightly to prevent the thread binding in the crotch. The crank for winding the rollers is usually made as in Fig. 10, the idea being to have it removable.

Threading the Loom: This involves more careful work than the weaving. The warp material comes in hanks, balls, spools

and reels, but in any case it must be wound carefully on a warping board, Figs. 12 and 13, to prevent its becoming tangled when threading on the loom. To wind the warp, slip a large loop at the end of the thread over the peg A, Fig. 13, bring it under B and over C, and then around the other pegs in the manner shown until reaching E, then back over D, around the other pegs the same as the first thread until reaching C, which the thread goes under, then over B, around A as shown by the dotted lines, and return again until as many threads

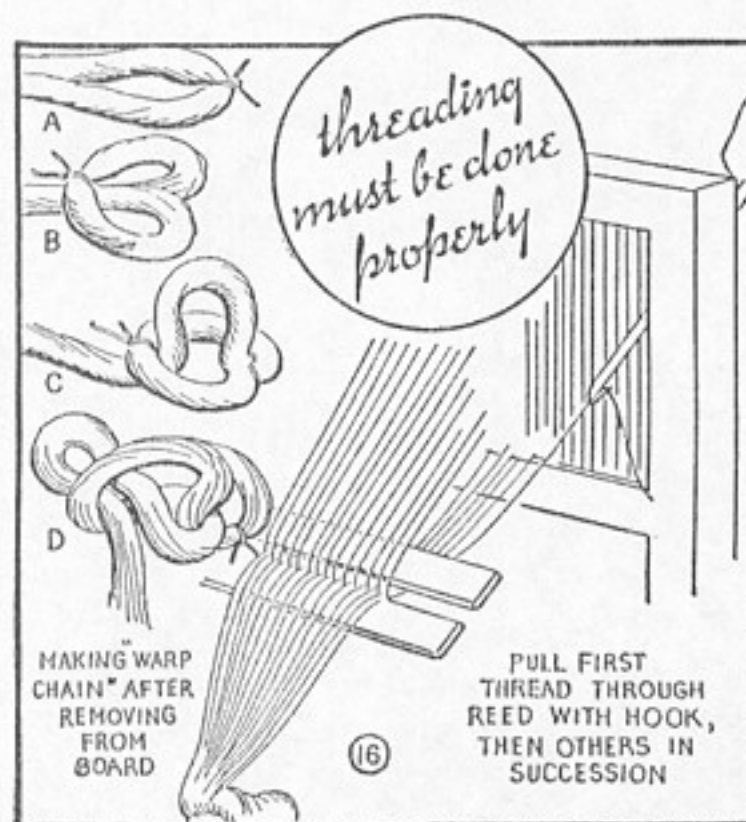
are wound on as the pattern draft calls for. Now tie cords through the crosses, Fig. 14, between C, B and A, as well as E and D, and carefully remove from the warping board. Next, you make what is called a "warp chain." The successive steps are illustrated in Fig. 16, A, B, C, and D. The purpose of this chain is to prevent the threads from becoming entangled before threading on the loom. These chains may be made up from a few to one or two dozen strands, depending upon the pattern, and there will be a number of them for each job.

This done, tie the tail end of the warp



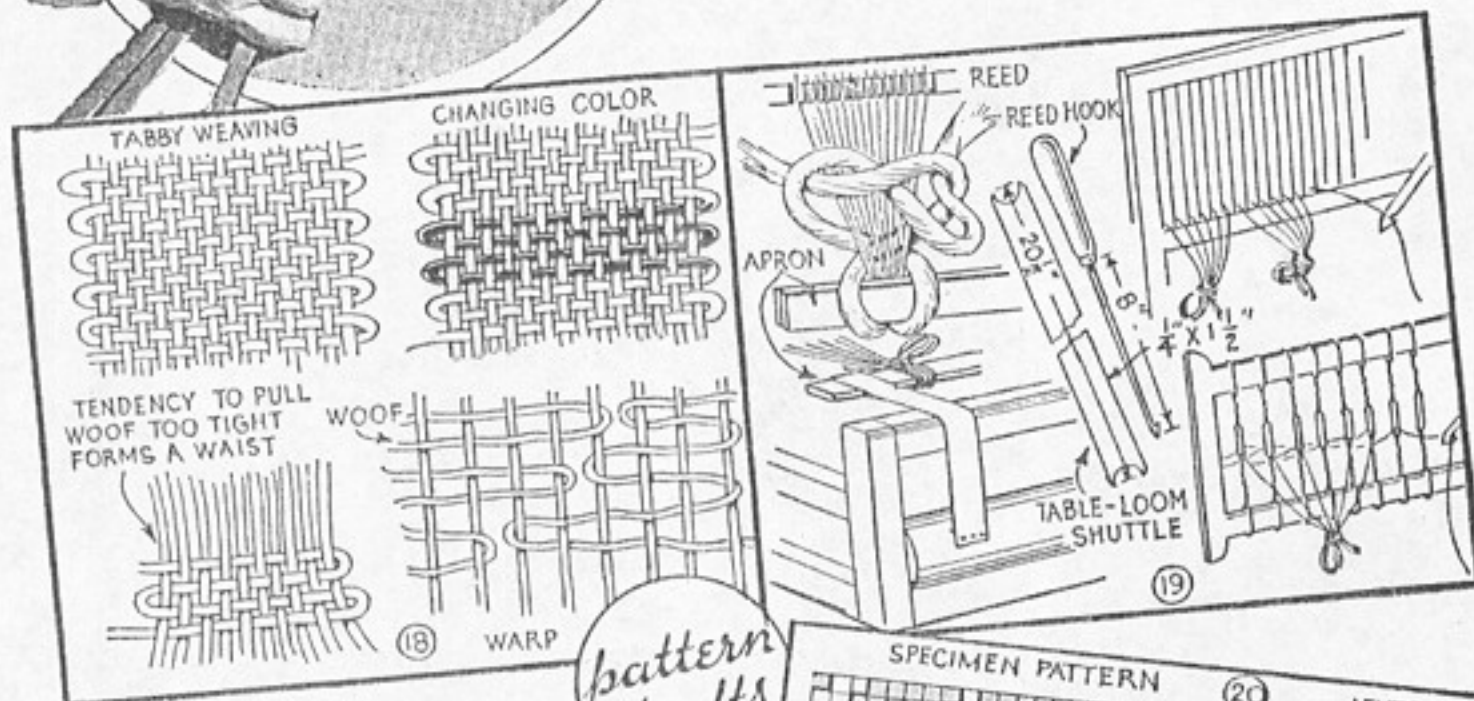
chain to the breast beam of the loom, Fig. 15, and having inserted two lease sticks in the crosses as shown, tie the sticks to the loom in the manner indicated, so that they will remain in place while proceeding with the work. Cut the ends of the threads and with a reed hook inserted in the back of the reed, draw the first thread through the first slot, Fig. 16, the next through the second, and so on, tying every few threads temporarily with a slip knot at the back of the reed as in the upper-left detail in Fig. 19.

When all are threaded through the reed, start bringing them through the heddles. The pattern draft purchased with your material will indicate which heddle each





wool. At the start of weaving, thin strips of cotton rag can be worked in the same as wool to form a backing to work against, then several strands of thread, which should be sewn criss-cross later, for sel-
vage. Plain or tabby weaving, Fig. 18, is produced by simply passing the shuttle back and forth between movements of the heddles. Of course, to form a pattern you have to change the color of the warp when threading the loom, and then weave in another color of wool to get variations like



thread is to pass through—whether the first, second, third or fourth. Each eight or so threads—according to pattern—should also be tied back of the heddles temporarily until all are through as in the lower-right detail in Fig. 19. Now tie the ends of each group either to a stick or to a piece of cloth with grommets, called the “apron,” which is attached to the rear roller or warp beam as in Fig. 19. When you start winding, the warp chains at the other end will gradually unwind, through the reed and heddles, and, as they wind on the roller at the rear, sticks are inserted from time to time to keep the strands separated. When all the warp thread is wound, attach the other ends to the front roller, or cloth beam, in the same way they were first attached to the rear. If this has been done properly, the loom is warped ready for weaving.

Two shuttles are required—one for the woof, and the other for binding thread which goes between each thread of the

that shown at the upper right in Fig. 18. If the woof is pulled too tightly, it will form what is known as a "waist," Fig. 18. A bit of practice will easily overcome this tendency, however.

The simplicity of threading and weaving will be seen from the specimen pattern draft in Fig. 20. This appears involved but all you have to do is run the threads through the heddles in the order given by the lower row of figures, and, in weaving, move the levers in the sequence indicated by the figures at the right.

Patty and Danny Perlmutter pose with some of their more magnificent wax masterpieces. Most of them appear too pretty to burn, but make wonderful decorations.



Mechanix Illustrated

January, 1954

Candles Lighted Their Way to Fortune

Starting their trade quite by accident, the Perlmutterers have built up a \$100,000 business in highly artistic candles.

By H. W. Kellick

MOST of the persons who buy the candles that Danny and Patty Perlmutter make in their Woodstock New York workshop find them so decorative that they hesitate to burn them.

Such treatment of the Candelier candles brings untold joy to the hearts of the Perlmutterers. For, when the young husband and wife team first designed their two-lb., 12-in., hand-colored candles, many experts said emphatically that the tapers could never be commercialized.

But Danny and Patty resolved that their



Here is the candle factory, converted from an old schoolhouse, that produces over 150,000 candles each year. Perlmutter's employ 10 helpers.



Candelier's favorite candle-maker, Pat Wolvin, pours melted wax carefully into the "driftwood" candle mold. This is just the first, rough step.



Jim Matteson, one of the Candelier's young engineers, is shown carving some driftwood candles. This job requires much control, artistic skill.



Final step is to dip the candles into vats of color. Note that the candle that Danny is dipping has two separate wicks; it will burn for many hours.

candles were not only practical, but they were also things of beauty. Confident that their sculptured wax would fit into the decor of any home, the couple decided to expand their production program.

Like many other young folks who start their own business, neither Danny nor Patty knew anything about merchandising, distribution, or financial affairs. Neither did they know anything about candle-making. Patty was a designer who found her art talent being bogged down in a highly competitive profession, and Danny was a semi-pro baseball player who couldn't foresee a future in his game. They combined their talents, pooled a bankroll of \$500, and set to work in earnest.

Today, with the aid of ten trained employees, they sculpture more than 150,000 candles a year which are sold in department stores and gift shops throughout the United States. Furthermore, the Perlmutter's do a gross business that amounts to about \$100,000 a year.

Their 15 candeliers are hand crafted and beautifully designed. No two candles are exactly alike. They are fashioned in forms that may be applied to any decor. Shapes are enhanced, not distorted, by the dripping of the wax, and they are designed as year-round candles. They are durable, heat resistant, and they burn slowly, approximately $\frac{1}{4}$ in. per hour.

The Candelier idea began three years ago



Patty Perlmutter carries her artistic skills from workroom to the showroom. Note the varied shapes.

when Danny and Patty were shopping around for some candles to pretty up their home. While on a tour of stores, they saw and examined many tallow tapers. Somehow, they all seemed alike. Most annoying of all, they were colorless and of the conventional taper variety.

When the Perlmutter family departed for home, disappointed in not finding the type of candles they wanted, Danny suddenly popped up with a bright idea.

"Patty," he beamed, "you're an artist. Why don't you design your own candles?"

Later, that same day, Patty, fired by the challenge, played around with a block of sculptor's wax. She worked the tallow and dug into it with a paring knife, and the mass soon took on the shape of a piece of driftwood with two jutting peaks. The model weighed a little more than two lbs., stood 12 in. high and had a base about four in. around. Wicks were strung through the two peaks.

"That's the most unusual candle I've ever seen," Danny admitted. "Imagine a candle with two wicks. It's certainly different."

Suddenly, Danny envisioned tens of thousands of homes displaying their candles on mantles and tables, joining the ranks of other permanent family possessions such as clocks, bric-a-brac and other treasured personal objects.

However, when the Perlmutter family showed their design to a candle-maker friend, he agreed that it was beautiful, but explained that it would never sell because it could not be made to fit the decor of all homes.

Undaunted, the young couple were determined to give their revolutionary candle design a whirl. They picked up two vats from a nearby bankrupt candle factory.

Then they converted an abandoned kindergarten schoolhouse into a combination factory and living quarters.

An engineer friend showed them how to operate the vats. A relative, who is a chemist, provided them with a chemical formula for making wax. Through trial and error, the Perlmutter family finally managed to mix a workable batch of tallow. To their surprise, they then discovered that a mold was required for the pouring of the wax.

With the help of their engineer-friend, Patty designed a two-piece plaster of Paris mold which a foundry turned into a permanent aluminum mold.

Finally, the Perlmutter family began dipping wax with a will. Proud of their handicraft, they placed a few samples on display in the tiny front window of their establishment. Although people stopped to admire the new-fangled two-wick candles, none took the time to buy. The suspense of anticipating their first sale almost drove the couple crazy. They began to wonder if their friends weren't right about their candle being a commercial flop.

Luckily, during the summer months, visitors began to stream into the art colony. One cool evening, a few strangers wandered into the Candelier plant. Overjoyed by the visit, Danny and Patty showed the visitors how they made their candles in their "two-by-four" workroom. Before the strangers departed, they bought a few driftwood candles at \$2 each. Needless to say, the Perlmutter family were elated in breaking the ice with these sales.

"When we sold \$6 worth of candles in a day," recalls Danny, "the place became a madhouse."

Soon word-to-mouth advertising spread around the Woodstock art colony. As a result, they began to do a brisk business. Steady orders kept the team hopping 18 hours a day, designing, sculpting, painting, and dipping candles.

Although orders seemed to flow in at a steady pace, operating and living costs consumed all the profits. To make a profitable venture out of their wax works, the Perlmutter family realized, they would need mass distribution. How to get it became a trying problem.

A solution to this problem was born early in the spring of 1951 when the couple decided to display their products at the annual New York Flower Show. Before the week was out, the Candelier booth had attracted hundreds of people and the Perlmutter family were literally swamped with orders for their candles.

A cocoa importer, attracted to the Candelier display,

had asked the Perlmutterers if they could make up a special cocoa pod type candle. "Sure," they had answered in unison. "Fine," said the customer, "here's an order for 2,000. I want to send them out as Christmas gifts."

Continued good luck blossomed for the Perlmutterers when Mary Pentland, renowned sales representative, stopped at the booth to admire the driftwood, ancient bottle, and Aladdin's Lamp designs. Mary had many solid ideas and connections. Through her aid, Candelier began shipping orders to class department stores throughout the country. Re-orders flowed in. Customers began asking for additional designs.

Many of the designs have come about by accident. For instance, one afternoon Patty was cutting away at a glob of wax with no special idea in mind. The more she carved, the more the wax turned into a modern form. It resembled a huge, uncut diamond and weighed two lbs. To make it salable, it was painted red to look like a flashy ruby. And to make it more interesting, Danny stuck three wooden dowels, four in. long, into the wax to form a stand. The uncut gem became a diamond in the rough. Sales figures prove that.

Not long ago, Jerry and Irene Rhoades, who sell hobby kits, wandered into the Candelier shop. After they were given a tour of the plant, they suggested to the Perlmutterers that it would be nice to make up a kit that could be sold to youngsters.

At first Danny and Patty balked at the idea. They claimed it was out of their line. But the Rhoades insisted that they make up such a set for it would be the only educational kit on the market that could teach the principles of molding to a child.

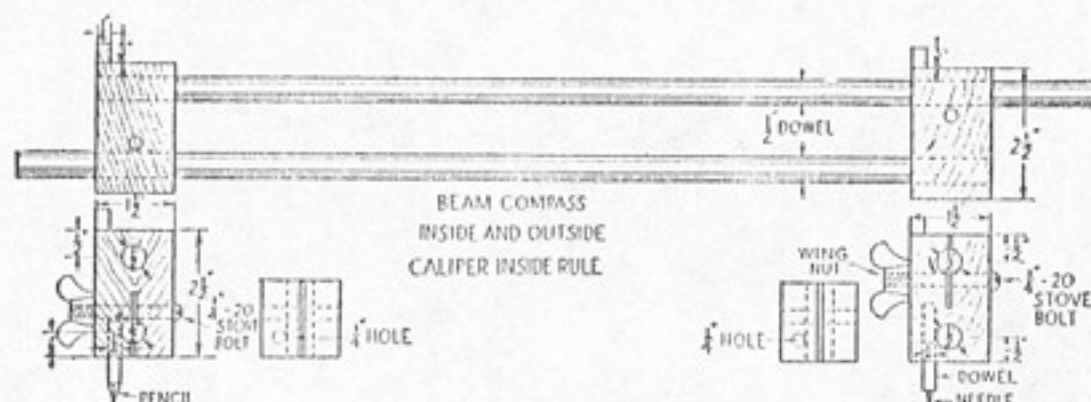
Now the Perlmutterers are marketing the Candelier Candlecraft set that retails for \$2.95 at hobby shops and toy departments. The set contains a lifetime mold, wicking, chunks of wax, test tube, carving knife, and separating liquid. Anyone, following simple instructions, can make candles just as the Perlmutterers do in their plant.

With increased business swarming all over the place, the Perlmutterers recently moved out of the old kindergarten schoolhouse and graduated to larger quarters when they took over an abandoned grade schoolhouse.

If business continues to boom, they may yet take over the local high school. They seem to be working in that direction. •

SCIENCE AND MECHANICS OCTOBER-NOVEMBER, 1941

Beam Compass Is a Useful Tool



THE tool shown in the drawing, a very useful one for the home craftsman, is used as a compass for making circles larger than can be made with an ordinary compass. Any size circle may be made from two inches up to the full extension of the rods.

It may be used also for measuring operations such as windows and doors. To check a door jamb, set the dowels and lock them in place, and then you can check the whole length of the door. It is also useful as an outside and inside caliper. When measuring a door on the outside, it may be set and tightened and brought down to the other end of the door to check for accuracy in width. It can be used for checking a large diameter opening. And by setting in reverse the pin holding the needle, it can also be used as a marking gauge.

This is a very simple instrument to make. All that is required is two hardwood blocks $1\frac{1}{2} \times 1\frac{1}{2} \times 3$ long. One end is cut off $\frac{3}{8}$ all the way

across, leaving a piece $\frac{1}{4}$ " thick. Drill two $\frac{1}{2}$ " holes with a clean cutting wood bit all the way through the blocks as shown in the drawing. Then, slit with a saw approximately half way through the length of the block and the full width across. Bore a $\frac{1}{4}$ " hole just above the dowel hole so that the bolt will clear the dowel and not rub against it. This bolt should be a stove bolt, $\frac{1}{4}$ "-20, two inches long. A wing nut should be used. A

washer may be placed between the wing nut and the surface of the wood to prevent tearing the surface.

Notice that each block is slotted part of its length. This is to allow the dowel to slide through. The hole opposite the bolt should be just large enough to let the dowels slide through easily, and when screwed together, clamped tightly. The holes on the end are $\frac{1}{4}$ ". This is large enough to allow the use of a short lead pencil and a $\frac{1}{4}$ " dowel for the needle point. An old phonograph needle mounted in the end of the dowel makes a very satisfactory needle point for the compass.

The dowels should be smooth so they will slide easily. Sand them down slightly after they have been mounted permanently in the block. They may be screwed into the block or nailed to keep them from moving. It is essential that the holes be drilled squarely so that the dowels will not bind while sliding.



MONEY MAKING OPPORTUNITIES

ALFRED HAMILTON, Editor

SCIENCE AND MECHANICS OCT.-NOV., 1938

Profits on the Floor



In selling his services to customers, Leo Santure carries with him samples of flooring showing the work he can do on various kinds of wood. His finished jobs always come up to the samples.

Mr. Santure has progressed from beginnings when he carried his first small machine over his shoulder to and from the job. Now his fine truck, pictured above, with him alongside, is a familiar sight on the streets of Monroe, Mich.



LEO SANTURE, over in Monroe, Mich., doesn't have to depend on holding a job in some factory or shop any more. Bosses mean nothing to him, and neither do weekly pay envelopes, wage cuts and that sort of thing. He's his own boss now, and his earnings depend entirely on his own industry. You see, he's become the guardian of Monroe's floors.

A number of years ago Leo got the idea that, if the average home owner could discover a way to have his floors refinished occasionally at not too great a cost, he would be glad to pay that price to avoid the mess of varnish removers, the sore knees and blistered hands of scrapers, and the days of inconvenience when the rooms had to be kept closed to permit the finish to dry.

He began with a single, small electric floor sanding machine and soon found out that his hunch was right. At first, the idea of having a man come in to do a job the householder had always figured was his own work, was a strange thing. And the added idea that a whirling disk, operated by electricity from the house circuit, could do in a few hours what it took days of

hand scraping, required some proving. Leo probably was discouraged many times in those early days. But he persisted. He did a little well-planned advertising. And gradually the idea caught on.

Mr. Brown, who was able to avoid the yearly spring drudgery of going over his floors by hiring Mr. Santure and his machine for a day or two, told his neighbor Mr. Jones about it. And Mr. Jones told Mr. Smith, and the news went down the block and all over town. Now, to use Leo's own words, "most of my work comes in unsolicited over the telephone."

He keeps three of the most modern machines busy most of the time. And he has his work so arranged that the preliminary cleaning and finishing can be done on one day, the floor left to

dry over night, the final finishing done the next morning, and the room be ready for use by noon of that same day. Contrasted with the old, messy, long-drawn-out method, this is speed indeed, all brought about by advances in modern electric floor-finishing machines of the portable variety, and the wisdom and planning of a man determined to make himself independent of bosses and weekly pay envelopes.

Leo's original capital was \$150. Today his busi-

ness averages \$3,600 a year and he laughs at the long lines of jobless, the gangs on short time, the weekly worry about how long the job is going to last. He has a full line of the best of machines, a fine truck to carry them, himself and his materials to and from jobs, and is a respected business man in Monroe.

What he has done for himself there, he says, can be done for other men by themselves in a thousand towns and cities in the United States.

Pulling Strings for Dollars



THERE isn't a very wide dividing line between having a hobby for fun and having a business for profit. Some folks may have doubts about that, but not the four people in Hamburg, N. Y., who have banded themselves together in the Hamburg Puppet Guild.

A few years ago, these four and some others were having a good deal of fun—and not much else—out of amateur theatricals in their home town. Incidental to their activities, they once invited a group of puppeteers from Buffalo to give two performances in their theatre.

Puppets are those little dolls, actuated by strings, made to go through amusing pantomimes. They are the original crude Punch and Judy, familiar to the watchers of side-shows and medicine trucks, raised to an art. The Hamburg Little Theatre group were surprised a bit to discover that a group of such jointed dolls, with strings in skilled hands, actually drew more public support than many human actors. It set them thinking, and thenceforward, a good share of their activities were devoted to developing, in their own group, a talent for making, operating and using puppets in performances of their own. It was all still in the nature of a hobby, you understand.

But times got harder. One of the group needed a job. She didn't get very far until a kindly friend offered the advice that she do what she was best fitted to do—try to sell her acquired skill and experience with puppets.

She approached her companions—three of

Here are a group of puppet characters created by the guild which they make and sell. They have also prepared a manual of instructions and a book of plays featuring these characters.

them. They began their business with a total capital of \$50—\$12.50 each—and a newly developed modeling material which made the manufacturer of puppet heads and features a shorter and more precise process than it had theretofore been.

The business, obviously, as it grew, did not turn out to be one of making and selling puppets only. The whole idea had to be sold. Even the art of handling puppets had to be taught to prospects, so that today the Hamburg Puppet Guild makes and sells puppets; prepares and distributes kits for those who want to make their own; puts on puppet exhibitions; has a teaching division which gives courses in puppeteering at chatauquas, camps and schools; and, finally, has prepared and published books on puppeteering and of puppet plays which have won widespread use among puppeteering groups all over the country and in many parts of the world.

"We now have a traveling puppet display which is made up of a group of puppets, a stage and other puppet material which has been sought by schools and libraries from New York to California and from Florida to Maine," say Mary S. Pendleton and Siloma Andrew, of the Hamburg Puppet Guild.

"The mail order business has doubled in each

succeeding year and is bringing orders and inquiries from every state in the union, Canada, Alaska, Mexico, Australia, England, Honolulu, and even from South Africa.

"We have accumulated an adequate inventory. We have been called on to lecture and to give entertainments. Last winter, in a nearby city, came a demand for a puppet course. At the present writing one of the group has received an offer to present this course in a large university. From a hobby, to a business, to a profession—that is the course of our success."

His Hobby Pays Him Double

FOUR years ago Donald R. Fosler of Seward, Nebraska, found himself out of a job—one of the countless victims of the economic depression.

Fosler may not have had a job that gave him a pay envelop every Saturday; but he did have other things. He had resource, energy, and ambition. Also, in his basement he had a small woodworking shop that had occupied his leisure hours while he was regularly employed.

So this young man decided that he had to make his shop pay. He did, and what he turned out not only paid him 50 cents an hour for his labor, but it found him another steady position. Now he makes more money than he did before the depression got him. As Fosler says: "My workshop is a child of the depression; and my new job a child of the workshop."

Here is a view of a basement workshop of Mr. Fosler.

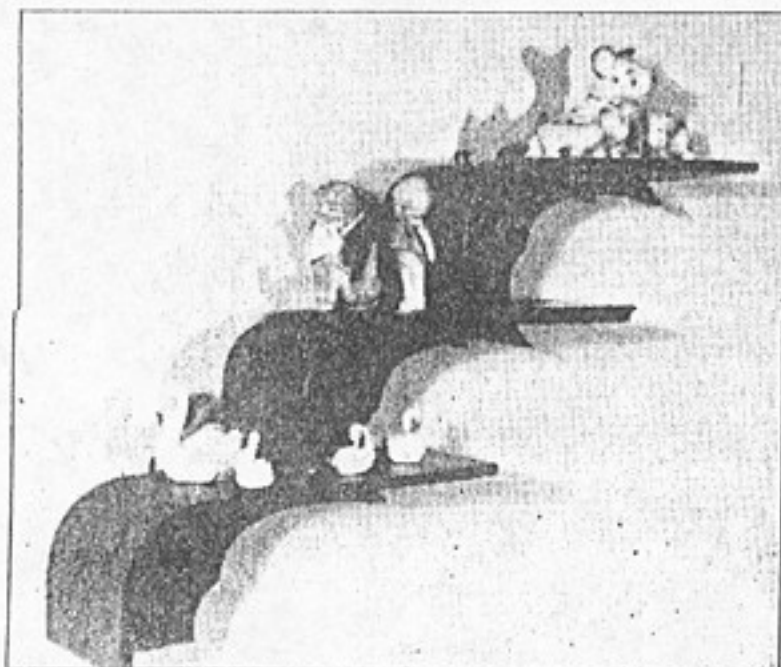


Waterfall Furniture

Fosler makes what is known as waterfall furniture—those several-stage "whatnots" that fit nicely into living-room corners, and upon which pieces of statuary, books, vases, and the like are so effectively displayed. He decided on this type of novelty simply because he had a suspicion that there would be a market for it. And he was not disappointed.

From a meager beginning, he now exhibits his home-made wares along with other novelties in the windows of the store where he is regularly employed. And he has sent other "whatnots" to stores in nearby towns on consignment. His biggest sale, however, came around last Christmas when he placed 30 pieces with a traveling salesman who sold them to other furniture stores.

Fosler computes his earnings of 50 cents an hour thus: His materials cost for one gum-wood waterfall with a walnut finish is 25 cents. His labor-time on each is about 4 minutes. He sells



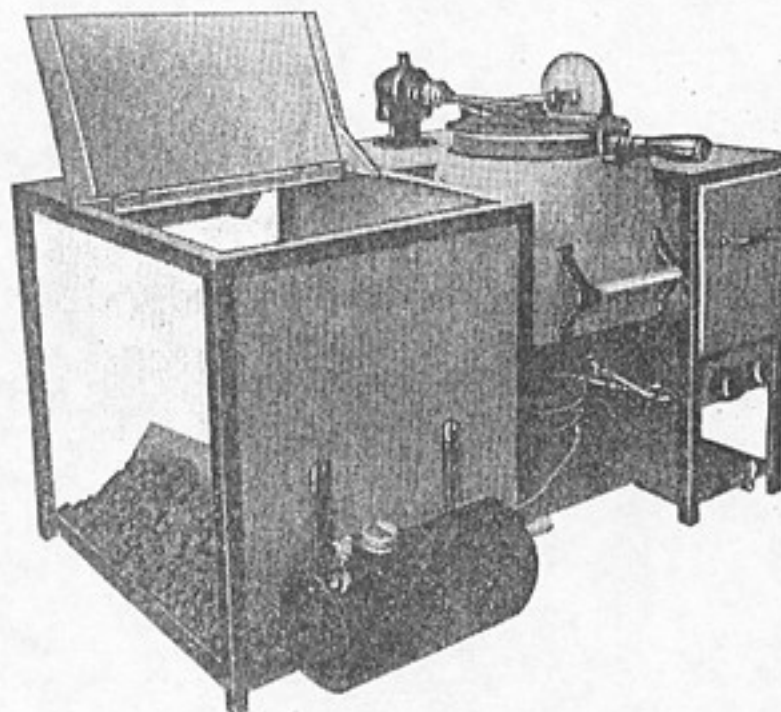
Department stores have sold many of these "waterfall whatnots" made in the home workshop.

them for 65 cents each, so that they may be retailed for one dollar or less. The earning of his labor is therefore 40 cents for 45 minutes, or at a rate of about 50 cents an hour—53 cents to be exact. His cost, it will be seen, does not cover depreciation on his equipment, nor any rental for the space the equipment occupies.

But this shop, once his hobby, not only got him out of a depression slump, but it got him another job. In other words, what had been a hobby now pays him double dividends.

A Welder Makes a Popper

IT WAS the fascination of the northern lakes in the summer that gave E. R. Taylor of Malcom, Iowa, the idea that resulted in building a corn popping machine.



The pictures above show front and back view respectively of Mr. Taylor's home-built equipment.

"It occurred to me," he says, "that if a fellow had some small portable type of business that was profitable, he might spend the summer among ideal surroundings and drift south with the birds to some equally pleasant place in the winter."

Popcorn looked good to him. But popping machines were more expensive than his modest bank account could stand. He had seen them and he began wondering whether it would be possible to build one. The accompanying pictures show how well he succeeded.

"But he had to attain his objective "by the back door" so to speak, because he knew that it would require welding, and careful skillful welding, to build such a machine. Fortunately, he discovered, there were inexpensive electro-welders on the market. He purchased one and spent some time practicing the art of welding. Then he went to work on his machine.

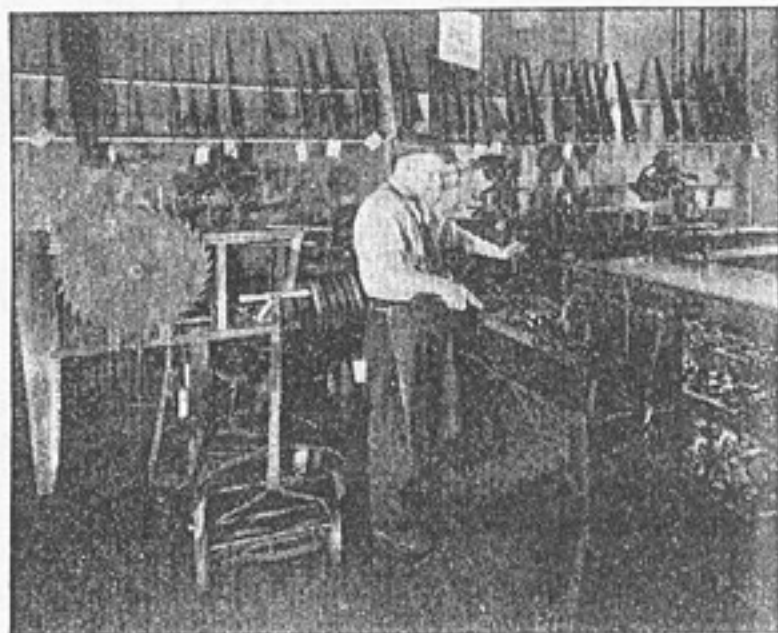
"My machine will pop from ten to twelve five-cent sacks of popcorn in about four minutes," he says. "As there is four cents profit on every sack, the machine has a maximum earning limit up to between six and seven dollars an hour."

Slight changes make the machine usable as a floor model, mounted on rubber-tired wheels as a portable vendor, or as a window display. The entire expense for parts and materials was about fifty dollars. "In a decent location," the builder says, "it will earn me more clear money than the \$2,000 I now have invested in my restaurant."

Another case where a sideline bids fair to replace the principal business.

No Depression for Stilwell

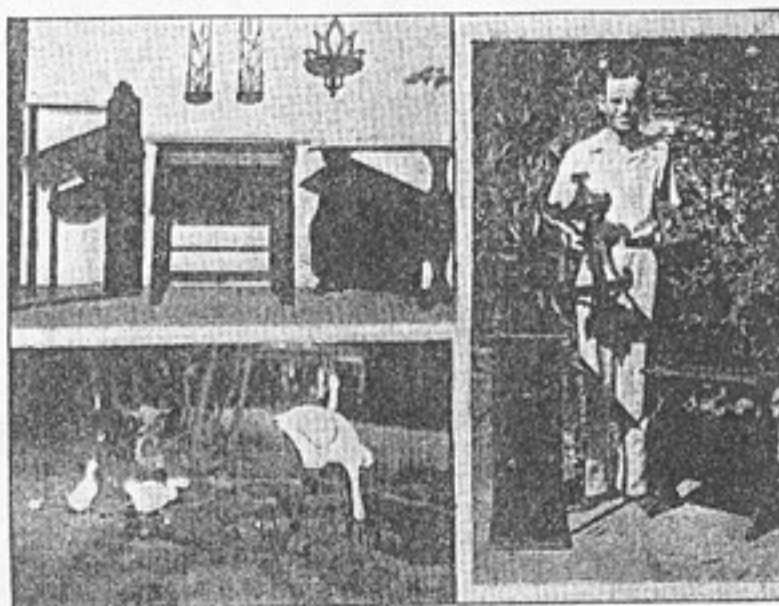
I. H. STILWELL of Chicago licked the depression sharpening lawn mowers and saws. He's made his living that way for several years. Beginning with a lawn mower sharpener in his



I. H. Stilwell of Chicago in his busy, modern shop for sharpening lawn mowers and saws.

basement, he has built up that end of the business until now it yields him \$1500 a year. He has made quite a reputation for himself. His regular customers begin bringing in their mowers for attention long before the grass needs cutting in the spring, and, increasingly, they bring neighbors with them, for they know that Mr. Stilwell will return them in good shape for a summer's work. Saw filing is an all-year-round business. In 1937, Stilwell filed no fewer than 3,080 saws. He has moved his shop out of his basement into a modern store building, and out of the depression, necessity and a small investment, has become a substantial business man.

Home Workshop to the Rescue



The pictures show John Jay with some of his work, a selection of his what-nots and furniture, and some of his popular garden ornaments.

JOHN C. JAY, Greensboro, Ala., had a bit of hard luck, like a lot of people in recent years. Twelve years of experience in banking went for naught, and he found himself with a government part-time job. Even that will peter out soon. But John has been thankful that he had a home workshop hobby. When things were bright, he thought of it only as a pleasant place to spend an evening and to make little things for himself and his friends. One day, however, some women saw him taking a few bird houses to friends in the office. They asked the price. John made his first sale. His equipment at that time consisted of an 8-inch bench saw. Since then he has paid for it, a 14-inch jigsaw, a 24-inch jigsaw and many hand tools and about \$80 over. In other words, his hobby has equipped a shop and showed a profit in addition. He plans to buy a drill press, a lathe and a band saw, and will expand his activities. "My workshop has been a grand pinch hitter from a financial standpoint," he says. Furniture, what-nots, ash-tray holders and garden ornaments are among the most popular numbers in his line.

A strange little livestock ranch in the attic gave Norton McKinney a new life and a \$10,000 crop.

By William Gilman

Mechanix Illustrated

April, 1949

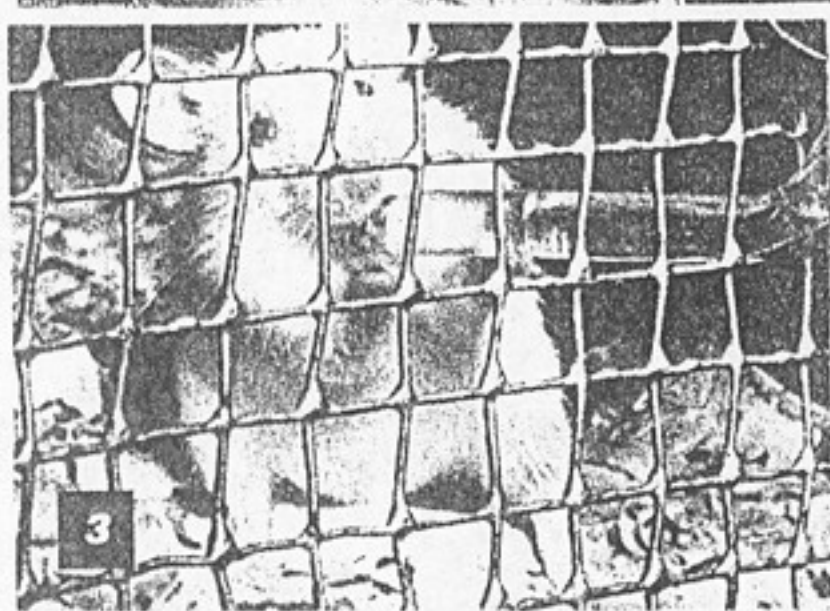
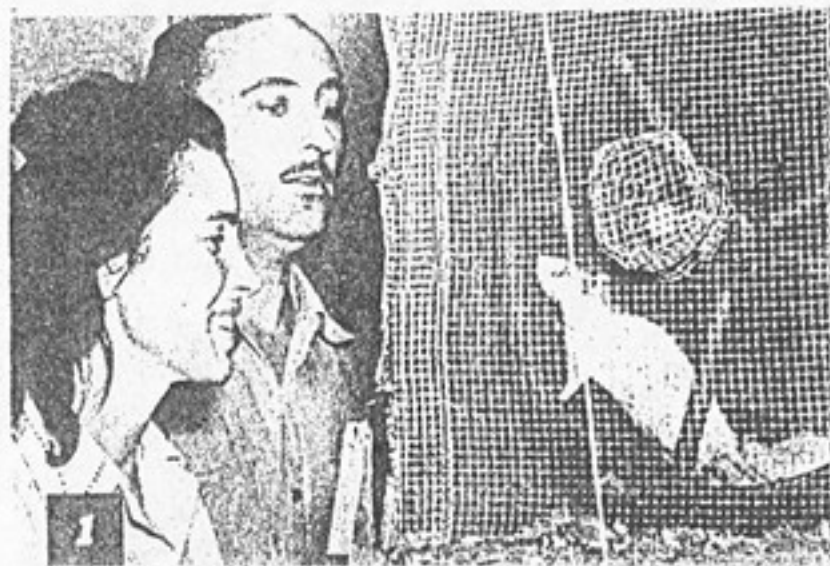
"**F**UNNY kind of a business for a fellow to get into," the villagers shake their heads as they glance up at the old mansion Norton McKinney bought in quiet little Middletown Springs, Vermont.

And it is a funny setup, all right. The attic in his antiquated home swarms with rats—mice, too. Last time he took a census there were 1500 adult rats and mice, with new litters running up the rodent population practically every day. You'd think his wife Georgia would raise the roof about that ratty situation up in the attic—but, no, she only wants to hear more rats racing around over their heads. She even helps him nurse and coddle new-born rats with germ-free water and purify the air they breathe with ultra-violet lamps. No wonder their place is called Funny Farms!

For McKinney and his wife are running a new kind of livestock farm—and raising a fine flock of rats. Last year they harvested a \$10,000 "crop" from their rat farm and they're expanding all the time. To meet the specialized medical demand for thoroughbred rats and mice, they are shipping more than 500 a week to leading laboratories. Soon they expect to make that figure a round thousand.

Science needs these testing animals to fight cancer, to test for pregnancy and venereal disease; to study dietary diseases like rickets, and to mobilize our health forces against germ warfare and atomic radiation. Some of his rats "stood in" for humans at the Bikini atom-bomb tests. Mice were used in developing the latest hope in the war on cancer—teropterin, which reduced

The only ratrace in McKinney's life now is the one at the top (Picture 1). Norton and his wife like to see Mother Rat enjoying her exercise in the treadmill he built. Picture 2 shows a Swiss-Albino mama mouse and her babies; 3, a young Sherman rat swigging a drop at his water fountain, and 4, the "livestock" stalls up in the attic.



the suffering and prolonged the life of the late Babe Ruth.

McKinney was a professional singer but three years as chief inspector in a Long Island City war plant proved too much for his nerves and left him at 34 too jittery to continue his job or to return to a singing career.

"What else can you do?" his doctor asked as he was convalescing during the spring of 1945.

Searching his mind, he thought of his hobby and said, "Raise white mice."

Anybody else might have snickered. Dr. Edwin Zabrisky didn't. He knew of the soaring laboratory demand for fast-breeding rats and mice, because their cells resemble man's and because they make ideal stand-ins for controlled experiments. Picking up the phone, he called Dr. Charles Slanetz, head of the Laboratory Animals Department over at Columbia University and director of a project for supplying Army and Navy researchers with testing stock. Dr. Slanetz asked McKinney to stop in.

From Dr. Slanetz, he learned that raising lab animals would be harder than just fooling around with white mice as a hobby. The test stock must be uniform and free of disease, or experiments wouldn't mean a thing. The scientist recommended Sherman white rats and Swiss-Albino white mice, all highly inbred stock.

At Middletown, it all looked easy at first when the litters began appearing. McKinney had \$100 worth of stock in his wife's unusual train "luggage"—40 rats and 150 mice. He was confident he'd get a government contract and start selling soon.

The pregnancy period of a mother rat or mouse was only 21 days. There were about 10 to a litter. He'd sell some and keep the rest to build up his breeding stock. The young would be ready to breed 12 weeks after birth. It took the young only 21 days to be weaned and ready to sell, at \$1.25 for a rat and 30 cents for a mouse.

He had 400 rats and mice—counting the new litters—when, one day that first December, a mysterious disease struck his little livestock. He thought it was just "snuffles"—a common cold that affects rats and mice and isn't serious. Then the young started having convulsions. To add to his worries about this strange affliction, the mothers developed a pink ruff around the neck. That, he had heard, indicated lack of proteins in the food.

Nothing helped. The little fellows began dropping over dead. Then, in desperation, he tried a chicken feed recommended by a friend.

It worked almost over night, like a miracle. The weak survivors got back on their feet. The boils and convulsions disappeared. The white hair became glossy again. Of the 400 rodents he had before that protein plague hit the attic, he had only 30 left.

After he licked that mysterious death, he determined to raise the healthiest rats possible. He began suspending the breeding cages from the ceiling, so they wouldn't get any contamination from the floor. He set up germicidal lamps to keep down odors and purify the air. On each cage hangs a water bottle with a glass tube through which the rodents suck chlorinated water.

For bedding, he uses only fresh, kiln-dried shavings from a nearby sawmill. He refuses any that's been lying around. There's too much chance of mold or infection by "wild" rats and mice, which are carriers of the dread disease, paratyphoid. This is similar to typhoid fever in humans and ruins the animals for experiments. Paratyphoid, for instance, changes the percentage of calcium in their blood and makes them useless for research on rickets.

The Funny Farms business is based on keeping breeding stock at high virility. Males are used only six months, and females are kept a year, during which they raise three litters.

Many little things contribute to McKinney's success in raising rats. He cleans the cages twice a week. Once a month he disinfects them with a mixture of carbolic acid, green soap and creosote. A fan keeps sucking purified air through the attic. He sees that this nice, clean air is always kept at 70 to 80 degrees, which he found to be the healthiest temperature for his little livestock.

Funny Farms now seems a little less strange to the neighboring villagers, though they're still surprised that he can make good money out of rats. One oldtimer put it this way:

"Dawg-gone it! I kill rats and here comes McKinney who raises 'em—makes money at it, too!"

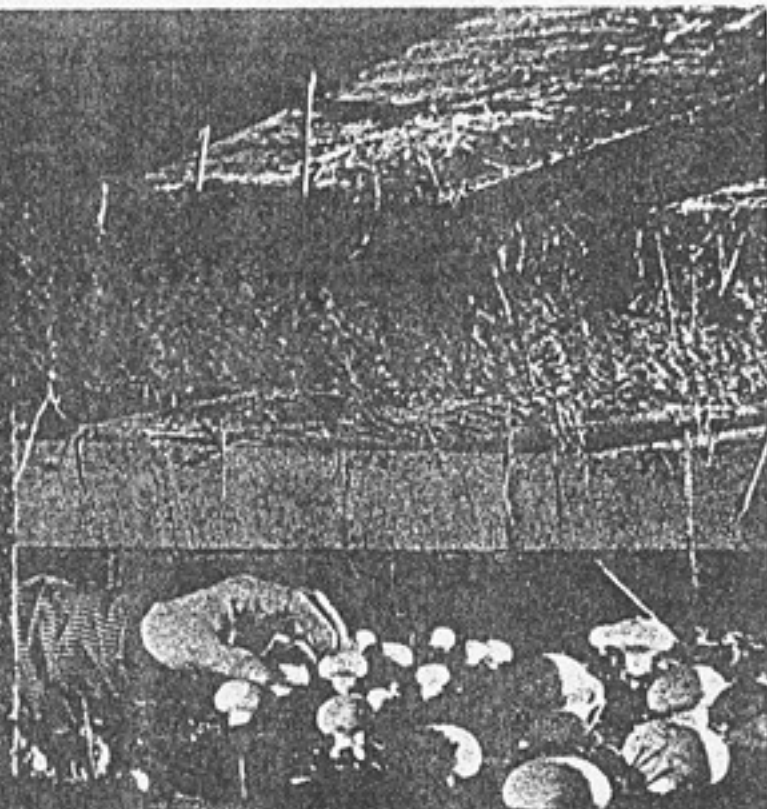
His rats are overflowing the attic, and they're busy getting some of the second-floor rooms ready for more.

Rats, of course, have an unlovely reputation. But McKinney loves the friendly little animals and he's proud to raise them and call himself a rat farmer. They helped him escape a real ratrace in the big city. Not only are they giving him more money than he ever made before but he's living a fine life of peace and quiet. Anybody who's scrambled for a living in New York will know what he means. •

Mechanix Illustrated
May, 1950

a money-making

IDEA



My Profits Are Mushrooming

A small corner in your basement and a bit of fungus mold are all you need to start a mushroom farm and grow yourself a big-money business.

By Corwin Fred

BACK in 1929 I knew nothing about running a business. I did know, however, that I wanted one of my own, and I realized it had to be some enterprise I could start without much cash—and learn as I went along.

A few months later the profits had really started mushrooming from my own business—growing and selling mushrooms. As a mushroom farmer, I've been squeezed into some tight corners—but I've squeezed out again. In 21 years of planting, nursing, harvesting and marketing millions of these fancy fungi, I've learned to love 'em. Not only because they pay my salary but because they're good to eat—and I eat 'em every day.

I was first initiated into the fraternity of mushroom raisers when a neighbor in my home town of Lebanon, Ohio, gave me a job on his fungus farm. After helping him grow mushrooms for a while, I decided that this was the life for me—if only I could set up an operation of my own.

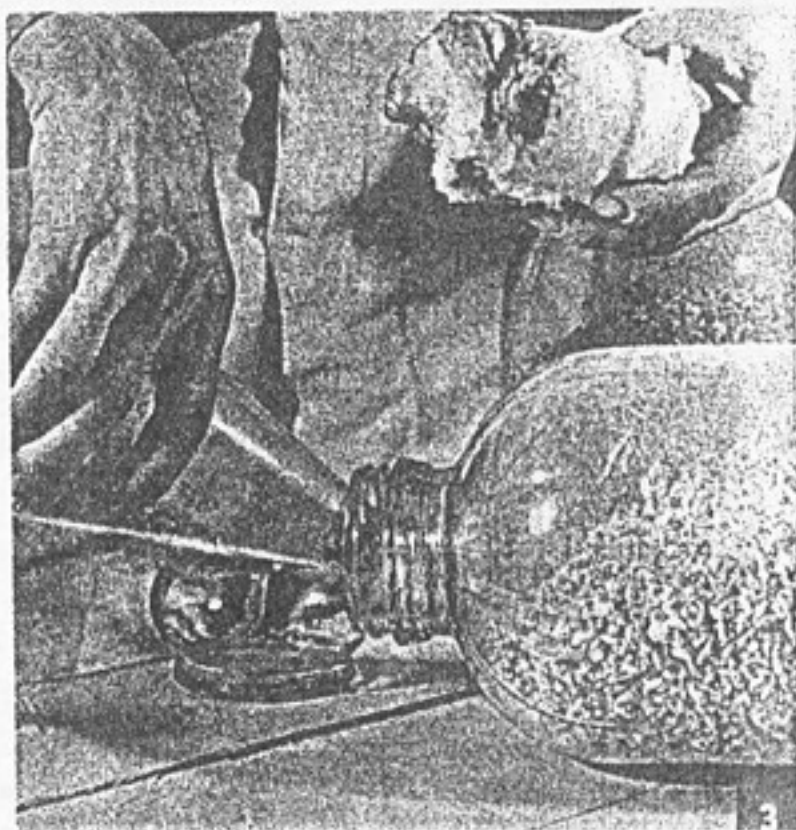
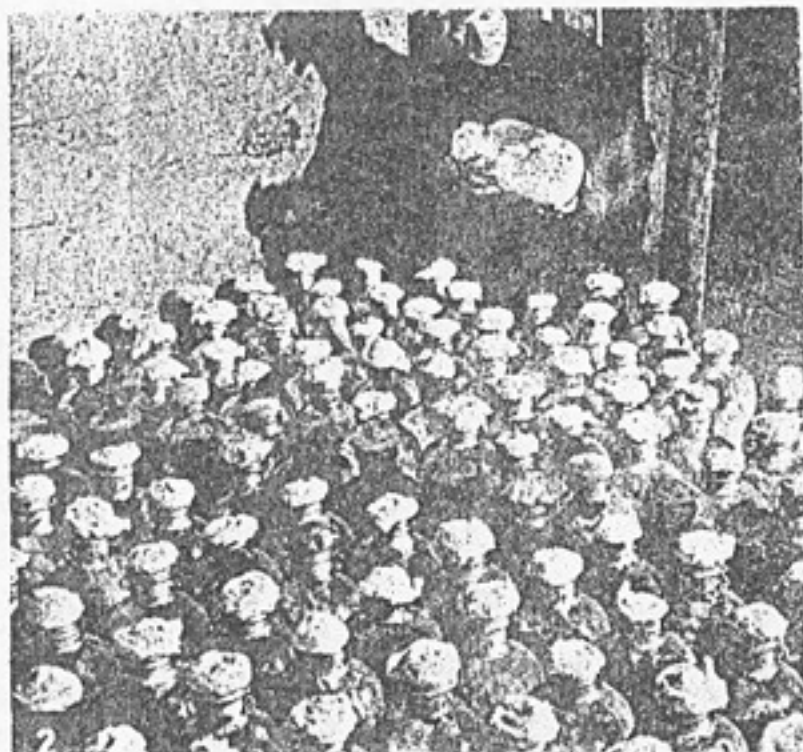
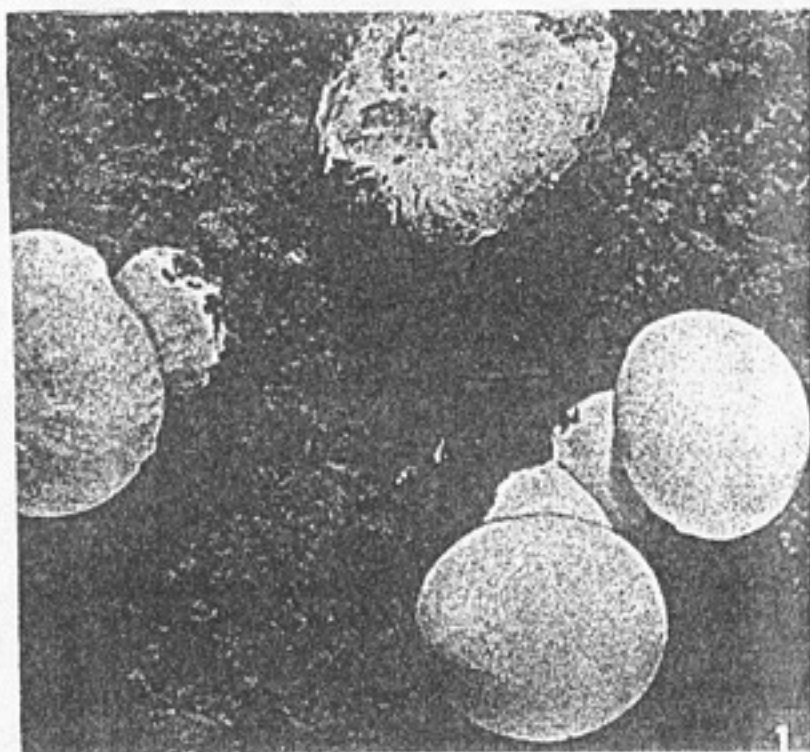
I didn't have much money and I still didn't know much about mushrooms. But the idea looked interesting and I was born with a bit of gambler's blood in my heart. So I simply forgot about my lack

of capital and jumped in with both feet. Of course, I didn't make much of a splash because I had to start out on a small scale. My first job was to find a place. Naturally I couldn't afford any special mushroom-growing house. Instead, I used my father's basement for growing my first crop. I made the mushroom beds myself from crating lumber I picked up at his store.

The basement location solved one problem but brought up others. One such obstacle I had to worry about was my older sister's opinion about mushroom growing in the basement. Mushrooms, you see, are grown on horse manure. I had a feeling that the idea of keeping manure under the living room where she entertained boy friends might touch off some fireworks.

It certainly did. She asked a couple of her boy friends to come in and try to make me forget the whole project. When they showed up at the cellar door, I must have looked pretty mad. They left quite suddenly—and I kept all my new mushroom beds.

My first two crops were good. Mushrooms sold at the time for \$1 a pound and there was a ready market for all I could grow. Then I ran



1 Twin mushrooms, lower right, are fine, healthy specimens, ready for harvest. Other two must be destroyed.

2 Corwin Fred, the fungi farmer, checks bottles of mushroom spawn before planting. Discoloration is disease.

3 To grow spawn for a new crop, spores from ripe mushrooms are put in bottles of sterile rye to form mold.

4 Fred's mushroom grower pours mature spawn into a carton before sowing it on beds in a blacked-out cellar.

5 In the dark mushroom "mine" a head-lamped worker plants a fresh crop by seeding spawn in layer of manure.

into road blocks on the highway to success. Disease and insects started doing better than the mushrooms in the basement beds. With my crops failing I had to borrow money to keep going.

It takes time to learn all the mysteries of the mushroom. I was in the business for about three years before I made a really good go of it. During that time I rented one basement after another to grow my profitable delicacy. I even raised mushrooms in the basement of the busy five-and-ten on Lebanon's main street.

My first real success was in an old stone building that used to be a brewery before Prohibition. The building combined many of the features that a good mushroom house should have. It was dark and cool enough to keep the temperature down near 58 to 60 degrees Fahrenheit which growing mushrooms require.

A year later I expanded into a large building on the site of my present plant. Everything was going smoothly until a local fire-maniac sneaked into the building one night and set it ablaze just to see the flames against the night sky. I rebuilt the house and later had additional buildings designed especially for mushroom production.

Today I have one of the biggest farms of its kind in the country. Ninety people help me raise and harvest a ton and a half of mushrooms daily from some six acres of darkened gardens in five special three-story buildings and a cluster of long one-floor houses. Each building has a watering and ventilating system to assure ideal conditions of moisture and coolness for maximum mushrooming. Endless belts carry the horse manure into, and out of, the buildings.

One of the most critical things I had to learn about growing mushrooms was just how to process that manure. After stacking it in piles and soaking it with water, it should be allowed to heat up in decomposition for about three weeks.

A couple of simple tests will tell you whether it's ready to move into the growing houses. First, twist a bit of it in your hands. If the time is right, the fertilizer should shear apart easily. Fortunately, when it rots for a few weeks, the manure loses much of its odor. You can even keep it in the basement under the kitchen without causing any bloody Donnybrooks in your family.

When it has fully ripened, spread it six inches deep in the wooden culture beds. After it has gone through another heat, plant the mushrooms.

The mushroom is a delicate growth. Though it is one of nature's simplest plants and, unlike green ones, needs no sunlight, it is also one of the most exacting. It reproduces from spores—single cells too small for the naked eye to see. Each full-grown specimen gives off millions of these tiny spores. To get these ready for planting, put spores from ripe mushrooms in glass jars with sterile rye or pieces of tobacco stem. They will keep growing on the rye or tobacco until the jar fills with mold. This is called spawn. You can buy it from the Mushroom Supply Co. at Toughkenamon or from J. B. Swayne at Kennett Square—both in Pennsylvania. It sells for about 50 cents a bottle, which is enough spawn to plant about 80 square feet of bed space.

After planting, the spawn continues to grow until a white mold-like culture called mycelium is formed. A layer of sifted soil is then spread on the beds. In three weeks the tiny mushrooms begin to "pin up"—or sprout—on these beds.

Once you start picking, you have to pick every day. A mushroom left a day too long is wasted. From the beds, the harvested mushrooms are routed through the packing room where girls pack them into half-pound cartons. These go to grocery stores within an 800-mile radius.

My first cellar crop produced a pound and a half to the square foot, which is good production. I raised them in trays so that I could carry them around and stack them on top of each other.

The present wholesale price of mushrooms ranges around 25 cents a half pound. Figuring a pound and a half grown on every square foot of bed space, the income per square foot would be about 75 cents. The beginner could have 180 square feet of growing space with six beds three feet wide by ten feet long. If his production is good he can make about \$135 per crop. It's better to start small, and then expand as you gain experience.

Mushrooms make an excellent hobby. The gardener who grows them need not forget his green thumb during the winter. He can keep in practice and at the same time produce mushrooms for the family and the local grocery. Then he can keep expanding till his profits have mushroomed him into a full-time career as a fungi farmer.

It's a good life, this mushroom farming. If I had to do it over again, I'd still raise 'em. At least this way I can *always* have my own mushroom sauce whenever I want it—and *usually* afford the price of the big, juicy sirloin to go along with that delicious sauce, too. •



With a bent tablespoon and a magnifying glass, Ant King Hornaday goes hunting for specimens.

My Business Is Built On Ant Hills

By Delyn Hornaday

Mechanix Illustrated

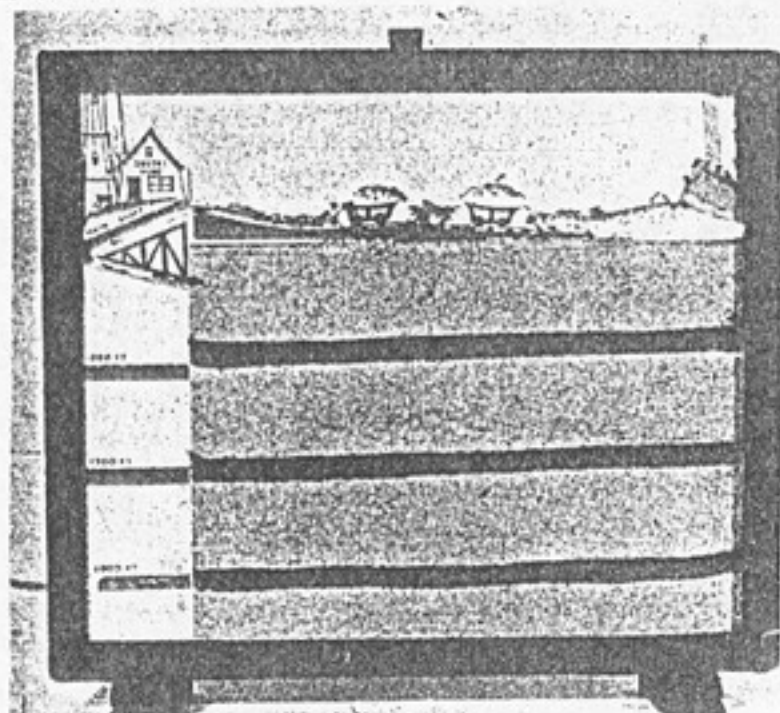
October, 1950

TWENTY years ago I discovered gold in them thar hills—and when I say hills I mean ant hills.

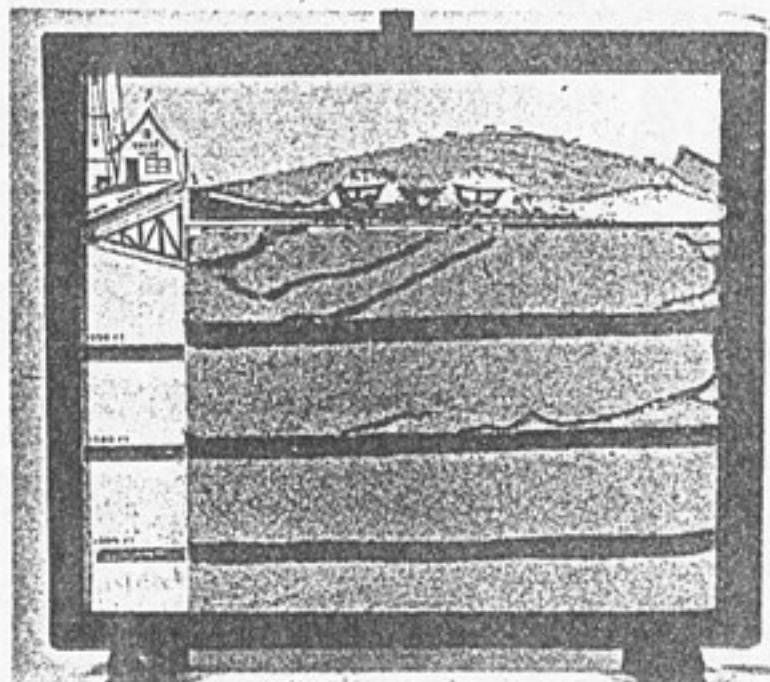
Ours was just like any other backyard Whittier, California. We had an orange tree, some clumps of ornamental shrubbery . . . and ant hills. For years we waged a battle against the little black critters—setting out poison paste and pouring boiling water down the hills. Figuring at today's prices, we foolishly destroyed about \$10,000 worth of ants.

I didn't realize our mistake until one day my college zoology prof passed out a class assignment: bring in 100 live ants for study. It was then that the backyard tenants I'd been destroying became my life work—and eventually led to a \$50,000 business.

I dug into an ant hill, grabbed a handful of dirt and threw the whole mess into an empty goldfish bowl. Next morning, as I carried my goldfish bowl to class, I



New ant colony, above, hasn't done very much work in 15 minutes. But after 100 hours, below, the insects have built a large hill topside.



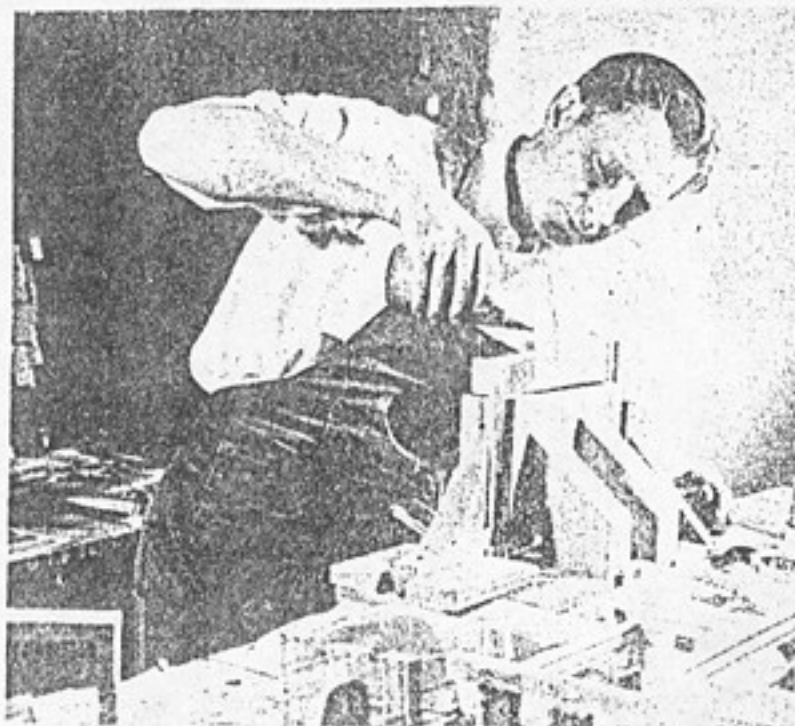
stopped short. Every last ant was dead.

Why had all the ants died? My zoology prof didn't know. Apparently neither did anyone else. Queries to leading universities brought identical replies, "We've spent a lot of money to find ways to kill ants, but never thought about keeping them alive." So I began to experiment.

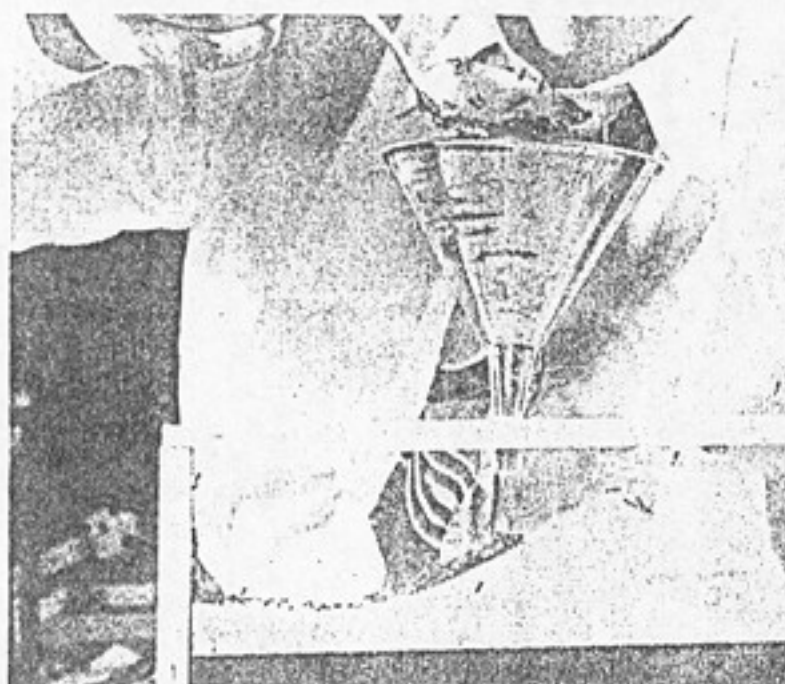
I found that ants die unless placed in dirt found near their colony. Apparently something in foreign earth kills them. I also discovered that they are fragile and you must pick them up one-by-one with a spoon. The touch of a human hand is almost always fatal.

Then I got an old picture frame, put glass on both sides and started a colony of ants. I had robbed them of all their privacy; they lived exposed to all eyes in the glass ant-village. Friends began offering to pay me to build them a colony too.

Soon a local newspaper carried the story, and one day the postman left a letter from



Hornaday fills village with native sand in which ants do their best work, above. He introduces them to new home by means of a funnel, below.



a lady in Oregon—would I build her a colony for \$25? I certainly would!

Then a local hospital bought a colony and discovered that bed-ridden patients never seem to tire of watching an ant village at work. Soon teachers—from kindergarten to university—queried me about my villages for classroom display. So did department stores and pet shops.

I began to see dollar signs before my eyes. So I gambled. I bought a half dozen old picture frames at a hock shop, invested \$2.40 for 12 panes of glass and started out with an old kitchen spoon and a mason jar.

Today, I ship thousands of these colonies in fancy frames throughout the nation every year. Some of them move on wheels and are decorated like circuses. One frame looks like a gold mine. We bury a brightly colored metal deep within the colony and in a few days the ants have carried all the metal to the top.

of their shafts—a fascinating operation.

The smallest ant village in a 9½ by 11-inch frame sells for \$3.95 f.o.b. Los Angeles, \$5 postage paid. The largest standard colony, 22 by 17 inches, sells for \$16.95 Los Angeles, \$20 shipped. This includes 50 to 500 ants in a separate container and a 25-cent bottle of Ant King food.

We charge \$1.50 to repack the village with fresh dirt—a tamping process we've perfected. For another 50c we'll restock it with ants.

Seven employees work in my shops in Burbank. We have a husband-wife ant-hunting team constantly in the Coachella Valley desert near Palm Springs. They have to locate and dig up five colonies a week because an average desert ant hill contains 12,000 ants, and our business demands 50,000 ants weekly. These are gathered and rushed to Burbank by Western Airlines within hours after capture. Despite years of research, we haven't yet found a satisfactory way to store ants.

During the winter, when ants hibernate, we have to pay \$5 per 1000 ants. The price drops to a dollar during the summer months. An average restocking requires 50 ants.

Sales of ant food are a continuous source of income—the production was forced upon us by colony fatalities. Ants, like humans, need balanced diets containing minerals, proteins and vitamins—particularly Vitamin B which gives them strength to carry bigger loads. I began to experiment with ant foods early in the business. Two years and about 1000 formulas later I shipped my first Ant King Ant Food.

Word of mouth, pet shop and department store window displays, ads in hobby and craft magazines have sold a lot of colonies. Twenty outlets—pet shops and department stores—handle them for me. I've never sought out toy shops because my villages are for educational study only.

Should you go into the ant business, you'll have to check with your own county and state Department of Plant Quarantine to discover just which ants are okay for shipment. However, you can always start an ant village business in your own backyard—as long as you don't ship them into another county.

To begin with, all you need is a quart mason jar ¾ filled with sifted dirt, obtained at least two feet below the surface to avoid fungus. Choose dirt close to the colony—this assures building material the ants are accustomed to.

An old window screen can become a dirt sifter. If the dirt is very dry, add about ⅓ of a cup of water until the dirt forms a loose ball when you squeeze it—mud will kill the ants. Faucet water usually contains too much chlorine or other chemicals, so use either rain

water or distilled water.

To get a fairly accurate cross-section of colony life, you'll need some workers, nurses, guards and eggs. In our operation, we spot a big colony, then dig around it like archeologists. The minimum trench is six feet deep, dug in a three-foot radius around the ant-hill hole. Good hills yield 12,000 ants—or about \$60 worth at winter prices, \$12 during the summer.

In the beginning, forget the trench, shovel, and special tools with which we excavate ant hills. Simply get a sturdy metal spoon and begin to dig. About a foot below the surface, directly beneath the hill, take about 10 ants. Then dig down another six inches and take 10 more. Spoon down an additional foot and capture 10 more ants. This should give you a colony cross-section—some workers, guards, maybe even nurses and eggs. Transfer these 30 ants, one-by-one, with your spoon to the mason jar, being careful not to crush them. Clamp a brass screening cloth—about 60 gauge—over the top. Next, because ants feel more at home in the dark, paste a black piece of paper over one side of the jar.

After you've learned to keep your village alive and healthy, it's time to start merchandising. An old picture frame—about 1½ to 2 inches wide—with glass on both sides is an ideal village. If you paint the frame, use vegetable base paint approved for children. Oil base paints will shorten colony life. So will tobacco smoke blown into the colony.

It's a good idea to sterilize the sifted dirt before you begin to pack the village frames. When I first started, I borrowed an ultraviolet lamp from a doctor friend and gave the dirt a sun treatment, stirring it all the while. A couple of minutes under the ultraviolet lamp should do the trick. This minimizes danger of fungus.

The village must be escape-proof. Drill two small, ¾ inch-diameter holes in the frame's top. Cork one and make it the feeding-water hole. Cover the other with brass mesh for ventilation. A medicine dropper full of distilled or rainwater every other day is moisture enough for the colony. Ants like a fairly high humidity, so cut a cellulose sponge into ¾-inch square pieces, attach a little wire and soak it in water. Hang this through the watering hole every day or so. Natural sponges contain too much salt which shortens colony life.

The colonies are building communities for themselves in thousands of classrooms and stores throughout the nation—with all the modesty gone out of them. Sure, my business is built upon ant hills—but they've proved to be a very sound foundation. •

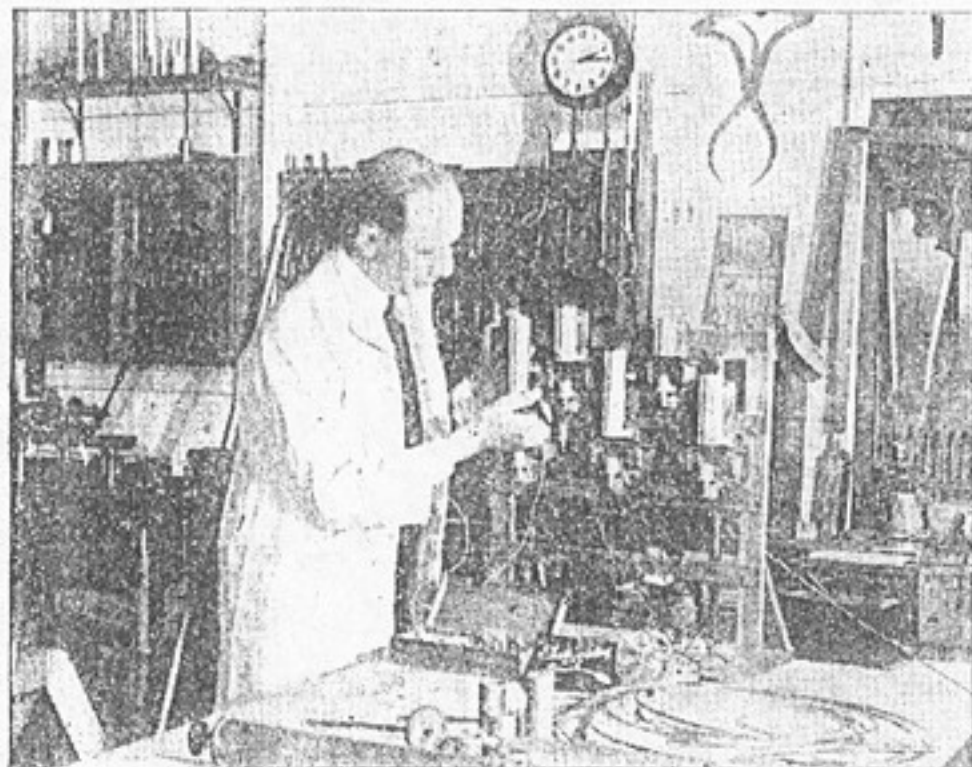


MONEY MAKING OPPORTUNITIES

ALFRED HAMILTON, Editor

SCIENCE AND MECHANICS APRIL, 1939

Easy-to-Do Electroplating Makes Dollars Grow



At the work bench is Fred Corwey, New York, busy plating a new musical device in his shop for making mechanical "props" for theatrical use.

WHEN a wideawake man, young or middle-aged or older, is looking for a sure way to make more and better dollars, can he find it? Yes, sir, he can. And here it is! Let him develop his own electroplating business! What? Electroplating? Why that brings up visions of huge tanks with smelly acid solutions, batteries, wall switches, longhandled dippers, hooks, and a lot of other messy equipment. So it was, but that vision is fading out nowadays. For a new and simple method of electroplating has been perfected, especially adaptable for use in the home, or shop, or store, or office, and in many other places, too. And therein lies a newly found way for a man to fatten his pocketbook.

Thanks to modern science, the new electroplating process does away completely with all tanks, and permits easy portability of the entire plating

outfit. Models that range in price from \$7.00 to \$27.00, weigh from three to eleven pounds and operate from dry cells or house current. The process uses an electric brush and a non-liquid electrolyte. The metal compound, available in various common and precious metals, is merely spread with a brush to which direct current is fed by the small electroplating machine. The brush is attached to the positive terminal of the control board and surface being plated is attached to the negative.

Easy to operate, the device can be used by anyone anywhere to deposit a heavy plating of gold, silver, nickel, copper, brass, zinc, cadmium, tin, etc., on metal articles, as simply as painting a board with a brush.

Entire surfaces can be plated as well as worn spots or edges. As the compound is non-liquid, it can be

worked in overhead positions or in other difficult places without danger of dropping. Objects to be electroplated do not have to be "taken down and sent out." Or small objects that can easily be picked up, can be carried to the operator's home and the work done there. Garages, jewelry stores, electric shops, key shops, bicycle shops, offices, factories, and countless home workshop, are the places reporting enthusiastic satisfaction with the new process.

How Nine Men Cashed in

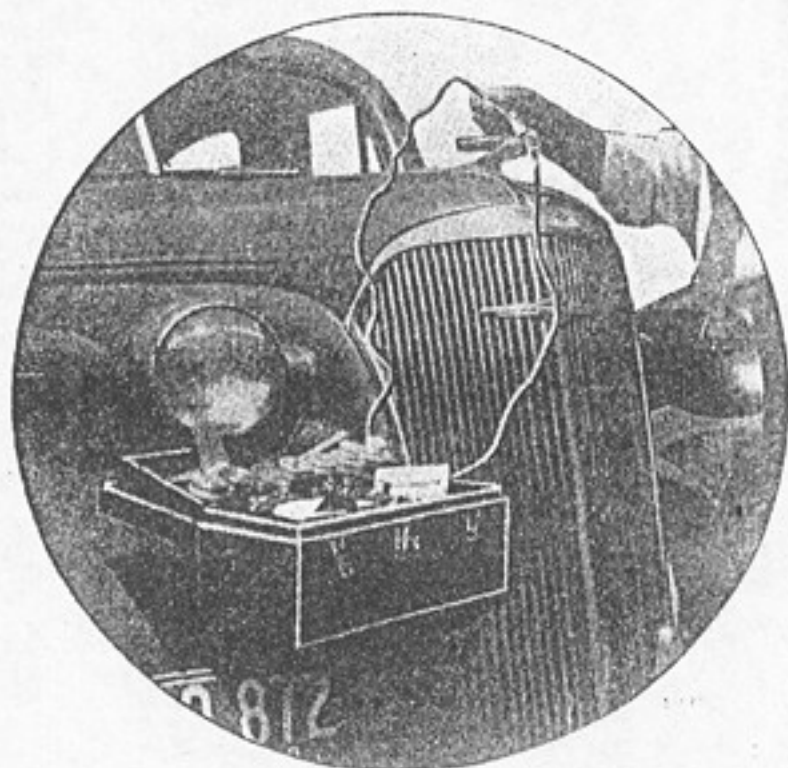
And has somebody hunting for spare time dollars or full time ones for that matter, actually used the process to his profit? Listen to the answers:

"I got a typewriter rebuilding company to let me go over 100 machines for them. And then a jewelry loan company gave me an order for replating their musical instruments in stock. I have even gone into a home to plate some faucets

and before I got through I had made \$10.00 in three hours," says W. R. Dixon, 217 Admiral Blvd., Kansas City, Mo.

"As a maker of stage props, I often had to take devices apart for plating," reports Fred Corwey, 315 West 47th Street, New York, N. Y., "but now I do not have to take them down and send the parts out, I do it on the spot."

"As a sideline I average \$20.00 a week. I put an ad in a paper. Then I arranged to pay a music store owner ten cents on every dollar of work he turned over to me. I had cards printed.



As easy to pick up and carry around as a fishing tackle box, the new electroplating outfit is here shown in use for plating an auto radiator cap.

I display my work in the music store window—and boy, does the work come in!" So reports Ray Kuhns, Cumberland, Md.

"I took a plating kit and went to a parking lot where there were many cars. I enlisted the help of the attendants and got permission to ask business as owners stepped out of their cars. And it was surprising to discover how many owners gave me an order to replate their auto headlights, especially the inner surfaces of the reflectors," writes C. Gabriel, 14564 Grandmont Blvd., Detroit, Mich. "I sold them new auto lamps, too."

"Three pairs of automobile reflectors netted me five dollars, the plating costing seventy-five cents," remarks Francis Edwards, St. Clair, Pa.

"I have gold plated to date more than sixty rings at seventy-five cents each," reports Charles N. Valade, Tupper Lake, N. Y.

"As a watchmaker, it formerly cost me \$1.50 to have a watch dial refinished," writes Charlie M. Underwood, Turlock, Calif. "Now it costs me two cents for the compound and I do the work myself."

"I use my plater for work on guns and pistols, and all kinds of silverware, and have discarded

my old tank system," says W. E. Irby, State Line, Mass.

"By replating metal parts on a show case, I made over twice the price of my outfit in three and a half hours," declares Howard Mullorky, 119 Cornelia Street, Plattsburg, N. Y.

"Want any more evidence, young man? There's plenty to be had. But a word to the wise—well, you know the rest of it."

Makes a Living With Third Dimensional Art Work

NO doubt you have noticed magazine cover illustrations reproduced in color from third-dimensional models. It is a comparatively new means of expression open to one who can both draw and carve, and has a sense of humor. Lee Brown of Long Beach, California, shown with some of his cartoon models in accompanying photographs, has been responsible for much of



A third dimensional cartoon magazine-cover layout carved by Lee Brown of Long Beach, California. You have seen his covers on popular magazines.

the published third-dimensional art. He tells us of his successful experimentation in the field of wood carving, developed from his original hobby of model boat building. After finding that he could produce life-like comical figures of cartoon proportions, with poses simulating action and emotion, it was no trick to place them in realistic atmosphere and shoot photographs for reproduction.

Mr. Brown's procedure is to submit sketches in full color to a publisher and, when these are approved, to transfer them to blocks of soft wood. He roughs out the figures with a scroll saw,

chisels and gouges, then employs regular carving tools and methods for shaping the figures into cartoon forms, and smooths them up and adds finishing touches with a hand grinder. Paint and varnish are next, then wardrobes, and finally the setting, or diorama, of which they are components.

Besides having orders ahead for magazine covers, artist Brown produces third dimensional figures for window displays. A photograph shows horses, riders and accessories of a complete race track layout built for a large department store, and one of his popular displays, for which he has continuous orders, are football teams with players sixteen inches high, provided with articulated joints so that they may be rearranged from week to week to simulate actual plays of current games.

Looking into the future, Mr. Brown sees great possibilities for third dimensional art in moving pictures, billboard advertising and other promotional work.

Blind But He Operates Own Radio Store



Although blind, Cecil Minard can check radio tubes on a push-button tester, and thereby make the dollars roll in.

BLINDNESS has stopped many men from going on with their life work and even from earning money, but Cecil Minard, of Sandusky, Mich., is not one of them. Since 1925 he has serviced radio receivers by listening to their reproduction or by using batteries and an earphone. He has built up a business which occupies all of his time and that of a service man who helps him with the repair work. He owns and operates his own store.

Mr. Minard had a special Braille tube chart made, which he uses in place of the usual printed chart made by the manufacturer of the tube tester. He can tell whether a tube is good or bad by listening to the amount of hum emitted by the tester transformer. To facilitate his work, the manufacturer arranged for the building of

a special tester with a hinged meter case so that he can feel where the meter needle rests. A special jack is added for ear-phone use.

So, when vision fails, try hearing. Many blind men have discovered that ears as well as eyes, or in the absence of eyesight, have a very real money-earning value, on full or on spare time.

930 Dozen Bags of Potato Chips

HATS off to potato chips! American nickels and dimes once went to popcorn or peanuts, but now it begins to look as if potato chips are to become the favorite with the small boy and the hurried housewife. At least that is what



Fresh, home-cooked potato chips have proved to be a "little gold mine," for Charles W. Fowler and his helpers, down in Virginia.

Charles W. Fowler, of Roanoke, Va., is thinking these days.

Wanting some extra dollars, Mr. Fowler invested \$140 in equipment for making the delicious cooked slices of potato, quickly sold his first samples, and in a very short time had established 141 customers, whom he services three times a week. He reports that repeat business is 100% satisfactory, and that scores of first orders are received by telephone from homes which he had not contacted. And, he says:

"Last month we sold more than 930 dozen bags (1 oz.) of potato chips for a total of \$370.00. Our cost of producing these 930 bags of chips was \$121.00, giving us a gross profit of \$249.00 for one month's operation. From present indication our second month's profit will run over \$350.00."



MONEY MAKING OPPORTUNITIES

ALFRED HAMILTON, Editor

SCIENCE AND MECHANICS APRIL, 1940

There's Cash in Cleaning Furniture and Rugs

"WHERE can I have my furniture and rugs cleaned?" a lot of householders asked Joseph Auer several years ago, when he was "a chauffeur on a moving van" in Mt. Vernon, N. Y. And every time he was asked that question, Joe did a bit of thinking.

Then one day when he was strolling along with his girl friend on a road where there were no sidewalks, she was hit by a passing automobile. "The accident wasn't serious," Joe says, "but it did bring out my real feelings for the girl." Then Joe did some more



JOSEPH AUER



thinking—a lot of it, this time.

And so, they were married.

Not long thereafter Joe found himself out of work, with sickness in the home, bills accumulating, savings gone, and no income. His one last financial asset was an insurance policy which had been paid up long enough to have a worth-while cash surrender value.

Then it was that Joe decided to be his own boss, to hire or fire himself, and to have a business of his own. In years before he had chauffeured a moving van, he had run a truck for an express company. But he turned a thumb down on the idea of going into the trucking business for himself.

Later he had been a soft drink dealer, but a too-cool summer had cracked up his expected sales, and that business had followed the drinks and the cracked ice "down the pipe, too." So he turned the other thumb down on that idea.

"But those home folks still want their rugs and furniture cleaned, depression or no depression," mused Joe.

Then he saw an ad in a magazine offering to establish him in a business of cleaning and moth-immunizing furniture, carpets, rugs, and drapes by a new, modern method. "That's it," said the ex-girl friend, now Mrs. Auer. "There's your own business. Let's go, Joe."

So go they did. Joe applied

On his first job, which included a chair like this one, Joe collected \$15.00 of which \$12.00 was cleared above expenses.



And this is the way that Joe moth-immunizes upholstered furniture, at a good profit to himself.

for a franchise in Mt. Vernon, made a modest down payment on the necessary equipment, and soon established Auer's Rejuvenating & Moth-proofing Co., operating in a national chain of independently owned service businesses. He doesn't need a shop because he can render his service right where the carpets and furniture are in homes, clubs, offices, hotels, etc.

On his first job, rejuvenating a large chair and settee, he collected \$15.00, making \$12.00 profit.

That was five years ago, and in all the years since then Joe has never had one complaint on his work. He says the process which he uses actually puts the life and beauty back into the furniture and rugs so that his business has grown from verbal advertising of his customers.

"My customers have really built my business," says Joe. "They are glad to pay more for my modern service than for ordinary cleaning and the customary moth treatments."

On his best day's work, two settees, two large chairs, six small chairs, and two rugs, he collected \$32.00 on which the profit was \$29.00. One straight carpet job brought in \$44.75.

"My service methods are certified and approved by a national organization," Joe says, "and they are always giving me new ideas and suggestions."

His average weekly profit has been \$75.00 but has run as high as \$125.00.

About 75% of his business is repeat orders from customers and 25% from new ones. He began building his business by telephone soliciting, mailings to prospects, and personal calls. None of this is necessary now. Work "just comes in."

Today, Joe Auer has a comfortable home of his own at 226 West Lincoln Avenue, Mount Vernon, N. Y., a new car, and spare time for recreation, thanks to his modern and superior services, his own initiative, and faith in himself.



When Runar Rodell completes his carving and painting of this black bass, it will almost deceive the expert fisherman who has his "big fish" mounted and hung on the wall.

Master Carver of Wooden Fish

WHEN a sick man must stay propped up in bed for two years, can he find something to do that he really likes, and can he make it pay?

"Yes, he can," says Runar G. Rodell, who lives at 1118 Lake Avenue, Wilmette, Ill. "I know because I had to do just that myself. For me, the answer was the carving of fish, and other objects, in wood. I have been doing it successfully, in bed and out, for years."

For eight years, Mr. Rodell had been working hard indoors in a department store in Evanston, too hard for his health. He fell ill, and had to go to Kellerville, Texas (north of San Antonio), where he spent the next two years propped up in bed.

"I had to do something," he says. "So I began carving in wood. I began to carve figures of people passing my window. They didn't know it, but they were my models. Carving became my hobby."

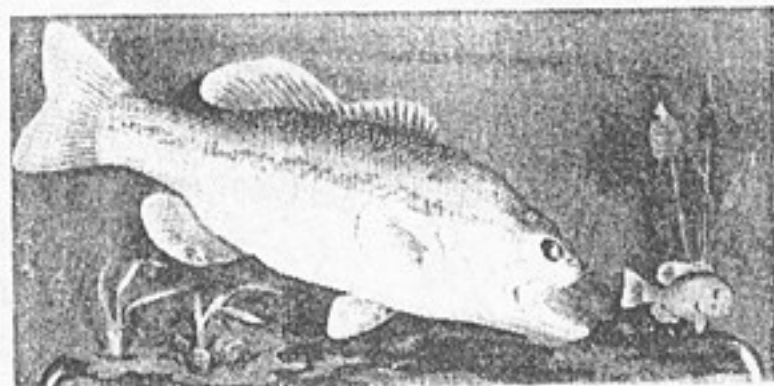
"Then it occurred to me that usually a man can connect his hobby with the things he likes most to think about. Most of my life I have fished. I know a lot about fish. So I started to carve fish, in wood."

After two years of this sort of handicraft work in Texas, Mr. Rodell returned to Chicago. Again he was in a hospital, this time for six months. This time he carved grotesque figures of cave men with rings in the nose, and similar queer objects. The wife of a fellow patient saw some of his wood sculptures and bought them. She

was a club woman—and her fellow club members bought too.

At home once more, he kept on carving, especially fish. He carved from memory, but his wooden fish, painted in natural colors now, were so good he kept on selling to his friends and their friends.

Mr. Rodell now spends much time each summer at the home of a married sister at New Auburn, Wis. Carvings that he does not imme-



Neither this big bass nor its blue-gill prey ever swam one flip of their fins. Both were carved out of wood and then painted.

diately sell she hangs on the walls of her cottage and shop. These passing motorists buy and take home with them—fishing trophies in wood, when the real thing is bait-shy. As a result, Rodell receives orders by mail all winter from all over the country. He fills orders for carved cats, dogs, horses, and of course more fish too.

"I carve mostly in white pine," he says, "but also in driftwood, soapstone, or other materials. I take a glass tank along when I go fishing. Into it I put the fish I catch which I want to carve in wood. Then I sit on the grass, study the fish, carve it, and paint the carving in oils direct from life. In this way I get the actual colors of the fish which change quickly, however, when it dies. I make an outline on wood when I carve a new species of fish but I carve the old ones from memory."

His most popular carving is that of a small fisherman holding up his catch. This has been sold to purchasers from all over the United States, in Canada, Mexico, and South America.

Mr. Rodell uses a Finnish hunting knife, called a pokkus, for carving. It is used in Finland chiefly for skinning game, and it is the same knife that the Finns are now using in fighting the Russians. He obtained the knife from his father, who as a mining engineer had received it from a Finnish lumberman.

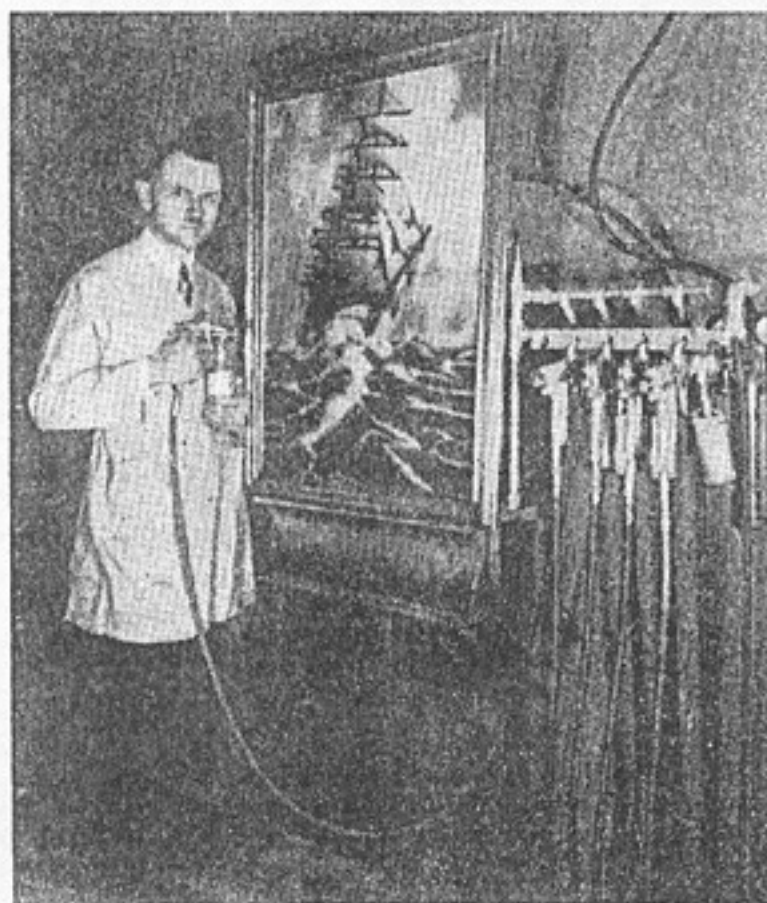
Carving is now fulltime work for Mr. Rodell. For his largest fish plaque (often a black bass) measuring 2 ft. long by 1 ft. high he receives \$25.00. He can carve and paint one of these in a day. It represents a fish weighing about 3½ lbs. For a smaller plaque, representing a fish weighing 2½ lbs. he receives \$15.00.

"It pays, and I am happy doing it," he adds.

Painting Pictures with a Spray Gun

FOR most men, it is a long, long road from the birth of a life ambition to its final realization. For far too many men the goal is never reached. Others, more fortunate, do find the pot of gold at the end of their rainbow. For Ralph L. De Gayner, of Channing, Mich., on the Upper Peninsula, the road was only six years long and he found his pot of gold by painting pictures with a spray gun! And today he is the world's first and perhaps only artist, we may believe, to paint pictures with a gun instead of a brush.

Way back somewhere in yesterday, Mr. De Gayner decided that he wanted to leave the city, go back to Silver Lake (near Channing) where he had spent most of his boyhood, build his own



Harnessing industrial science to art, Ralph L. De Gayner speeds up his painting of pictures on which he has cashed in and through which he has achieved a life ambition.

studio, and with his family settle down to "just painting the great outdoors." He has done it, and he is making it pay too.

After graduating from Iron Mountain High School, St. John's Military Academy, and the Oshkosh State Teachers' College, he spent a year and a half in the experimental department of one of the country's leading spray gun manufacturers. He had made his own first spray gun from a gas-pipe. In this manufactory he acquired an expert knowledge of spray gun construction and the great variety of ways in which this industrial tool may be used.

But the desire to paint was too strong to be resisted, so he completed a course in commercial

art, but gave that work up as a career when he realized it was not what he wanted to do. While still trying to "find the answer" for himself, he opened up an automobile repair and paint shop, taking the bumps out of fenders and repainting them and auto bodies with a spray gun.

While at this work one day, he suddenly got the idea of using a spray gun for landscape painting. He tried it on the wall of his paint shop, but the result was discouragingly "messy."

"But for six long years I kept on," he says, "and in all sincerity I believe I may claim to be the originator and so far as I know the only artist able to produce paintings with a spray gun and without the use of stencils."

And now he is making a unique place for himself in the world of art. He works with a battery of five guns each filled with a different color. He paints with almost unbelievable speed. An ordinary landscape he can paint in five minutes. He spends only an hour and a half in painting a clipper ship in full sail, with rigging details that would pass the close inspection of any old sea-going tar. His pictures sell from \$5.00 to \$150.00 each. During a recent traveling exhibit of his work more than 100,000 people saw his paintings. And this year, as last, his pictures may be seen at the New York World's Fair.

Why So Fast, Mr. Painter?

"Why such speed in painting pictures?" he often is asked. His reply is that he did some of his first spray gun painting in demonstration work for a spray gun manufacturer, and demonstrations had to be "snappy." In that way he learned to paint rapidly with the gun. He had painted more than 1,000 pictures in one year, and that too is a unique record for any painter.

So hats off to Ralph L. DeGayner! No wonder he is happy at his studio at Silver Lake. Mrs. De Gayner helps run the gasoline-powered compression unit which operates the spray guns. Eugene and Ralph, their two small sons, help father mix his colors. Life goes on joyfully, for a painter who made his dream come true.

Keyhole Light Lets You in and Lets Cash in Too

DID you ever fumble around in the dark trying to find the right key to your front door and then fumble around some more trying to find the keyhole, lighting matches or wishing you had a flashlight? Certainly you have. But did it ever occur to you that this fumbling nuisance offered a money-making opportunity? Perhaps not—and right there is where Wallace E. Babb, 1454 W. Third St., Davenport, Ia., and his younger brother, Harley E. Babb, 3735 W. Twenty-third St., Denver, Colo., got the jump on you. They saw the chance, and now they pocket the money.

Now it happens that back in 1916 when Wallace was only nineteen years old, he was stricken



Here's Wallace E. Babb busy at his working-bench, finishing and packing keyhole illuminators.



And this is Harley E. Babb, standing at a table on which he has opened up a demonstrator's display case, which any bright salesman can use in selling this keyhole illuminator.

severely with typhoid fever and infantile paralysis, on the farm in western Nebraska where he and Harley had been born and had grown to manhood. For five years he did not walk a step. Then followed months in a hospital after which he could walk a few steps with the aid of a brace and crutches. In 1925, he went to Davenport for more medical treatment and has lived there since that time, working in his home shop as a radio electrician. Harley came to Davenport at the same time, but has since then moved to Denver.

While the brothers were together in Davenport, their father worked at night, and on coming home in the dark often had difficulty in getting the right key and finding the keyhole.

"Why not put in a keyhole-illuminator for father?" one of the brothers asked one day.

The first illuminator was a large crude looking affair that used high voltage and had to be located on the outside of the door casing. It worked well, but it was not practical. Re-designed and new models followed until today the latest keyhole illuminator made by the brothers is small, neat in appearance, uses low voltage, and can be installed in only a few minutes.

"Patents, dies, and other necessary things cost us about \$350," writes Wallace. "Of course, we haven't gotten rich from this yet, but we are doing very well indeed. The cash keeps on coming in and the future looks bright."

And that's the story of how two brothers, one a tippie, recognized a money-making opportunity in "keyhole fumbling" and made it pay.



MONEY MAKING OPPORTUNITIES

ALFRED HAMILTON, Editor

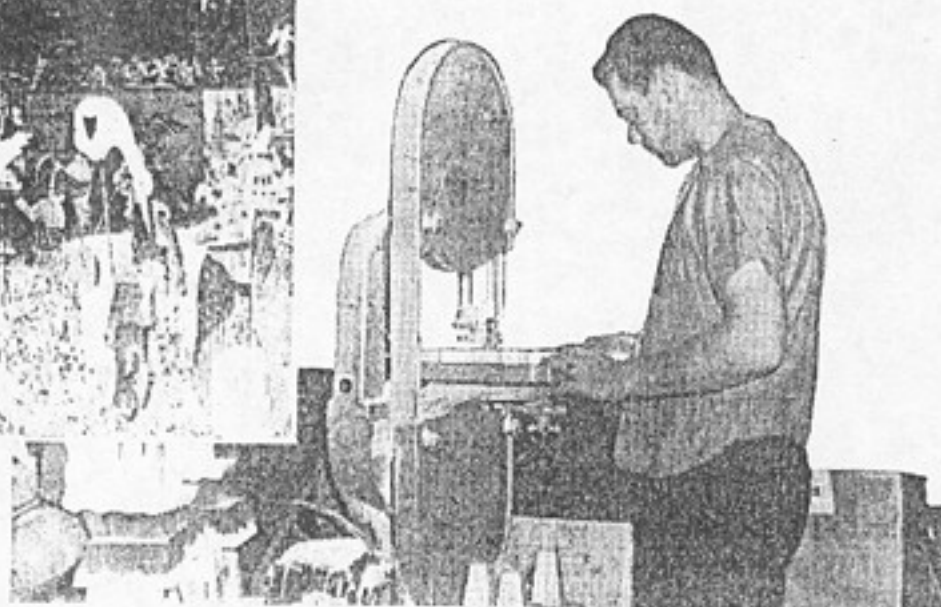
SCIENCE AND MECHANICS OCTOBER-NOVEMBER, 1941

Building a Profitable Business in LAWN ORNAMENTS



Outdoor display of the lawn ornaments which he has made builds sales for John Kolean in Holland, Mich.

Kolean says he couldn't do business without a power-driven saw.



SEVEN years ago in "Tulipland," which might be a good name for Holland, Mich., twenty-one consecutive rainy days ruined the tourist business and also ruined any profits John Kolean, Jr., might have made that first year he tried to become a manufacturer of lawn and garden ornaments.

Today, John is a successful manufacturer of these ornaments, thanks to his own hard work, persistency, and creative and sales ability. Best of all Mrs. Kolean has worked with him loyally and prospered with him. No wonder they have seventeen dealers who purchase their products in wholesale lots, from his garage workshop at 61 West First St., Holland, Mich.

How did Mr. and Mrs. Kolean accomplish all this, which dates back only five years because after the wet season of 1934, they started all over again from scratch in 1936. Let John tell the story. He says:

"After leaving high school here in Holland, I was employed by the Hart & Cooley Manufacturing Company as a drill press operator. I kept dreaming about building a business of my own

and in my spare time I made up some designs for lawn ornaments. I purchased a Delta bandsaw which was the beginning of what is now a completely equipped Delta workshop.

"The first ornament that I made was a Dutch girl with a sprinkling can. Mrs. Kolean decorated the ornament in brilliant colors characteristic of the native Hollander. I made up a number of additional items such as a small windmill, a farmer boy, a dog, ducks and frogs. With a limited number of garden ornaments on each of these items, I made a display in a vacant lot near my home.

"I will never forget the thrill I had in planning the display and in waiting for my first customer. Like many new enterprises, I had a most discouraging experience. It rained for twenty-one consecutive days and this made it practically impossible to display the merchandise. Further, the rainy season cut down the number of tourists and as a result I lost \$50.00 the first year I was in business. So I dropped it all.

"But I kept on trying to find a way to improve the appearance of my novelties and work out

unique and new items which would attract business. The more I thought about it the more I wanted to give the plan another trial. So in 1936, two years later, I blossomed forth again as a manufacturer and dealer of wooden garden and lawn ornaments. I had an excellent year.

"With the profits that I made, I purchased additional equipment which enabled me to cut my manufacturing costs and produce better items. I purchased a spray-painting outfit which speeded up the painting operation and cut down manufacturing costs. Mrs. Kolean continued to hand decorate the projects where handwork was necessary.

"With the profits from 1936 I increased my inventory for the coming season. We had favorable weather in 1937, 1938, 1939 and 1940. By concentrating on fast-moving items only, the business began to show a very satisfactory profit. Nineteen forty-one will be by far my best year.

"Each year the City of Holland celebrates the Tulip Festival. Thousands of tourists come to Holland to join the festivities. It is during the Tulip Festival week that I enjoy my largest sales. In fact, this year I had my products on display in three different locations and employed eleven sales people.

"My workshop is now located in my garage. I have a bandsaw, an 8-inch and 10-inch mitre saw, a large drill press, a 4-inch and a 6-inch belt sander. This equipment is in addition to the power paint-sprayer.



Little Dutch boy and a little Dutch girl, with sprinkling cans, are favorites among the many ornaments made quickly from plywood.

"The garden ornaments are made of white pine which I purchase from a local lumber yard. I have learned through bitter experience what is the proper paint to use on the ornaments so that they will hold their color and withstand the weather. At the present time I use sixty-five designs. At the end of each season we check over the sales on all of the items and if any item is not selling in sufficient quantities, we drop it and add new designs that we may create for testing during the following season.

Money from Old Dry Cells

EVER hear of recharging dry cell batteries? August J. Martin of Seattle, Wash., not only heard of it, but he makes money at it. With a small rectifier, he hooks up other people's dry cells and lets the rectifier work while he sleeps, collecting for it from his customers. When work is slack, he buys up old dry cells and charges them, selling them for something less than the cost of new cells. Sometimes, in recharging, the cells take a higher voltage and heavier current



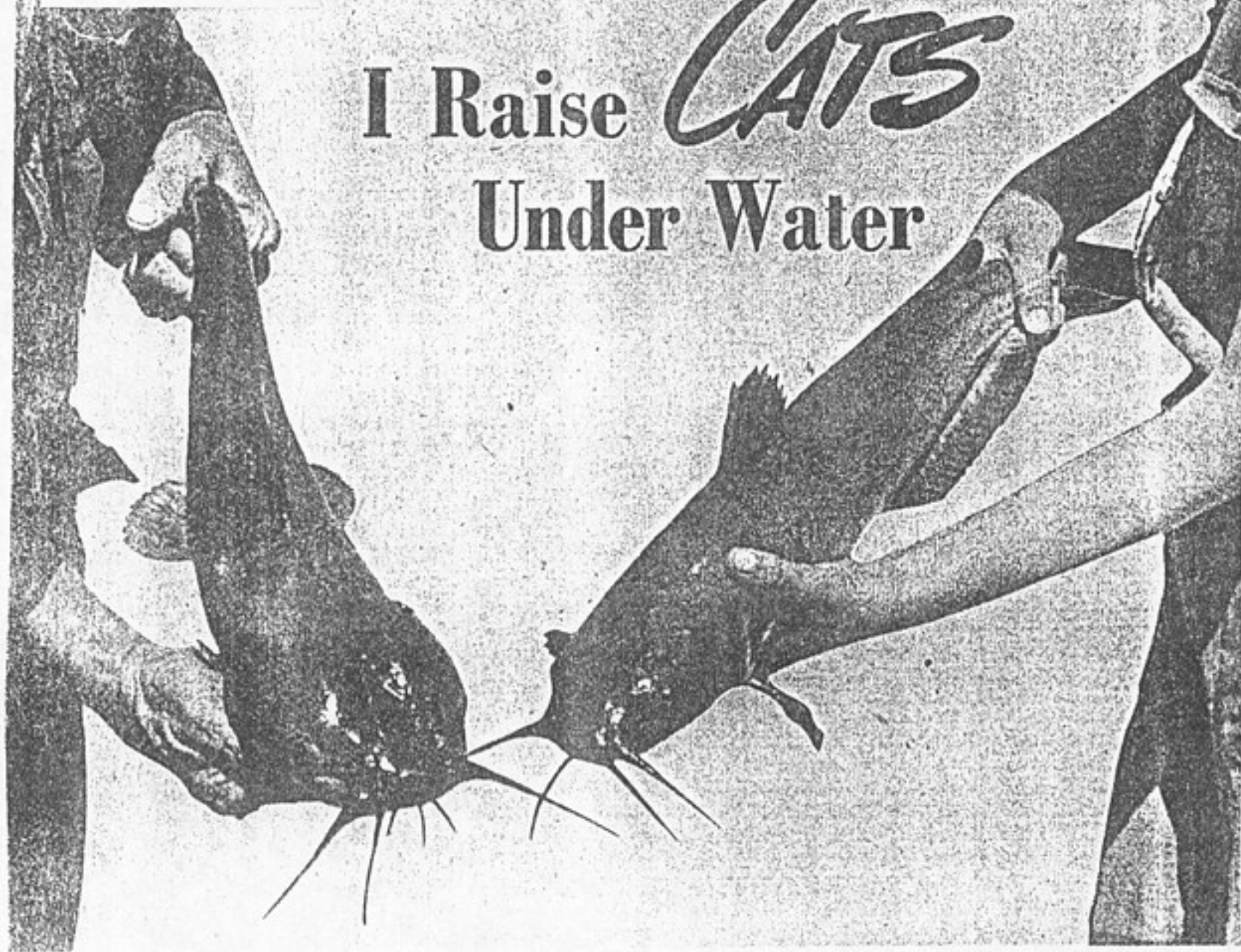
August J. Martin and his rectifier charging outfit.

when new. That is especially valuable to theatre ushers and policemen who wear out their flashlight cells in a few days. Martin warns, however, that not all discharged cells are fit for recharging. A good place to get small cells for recharging, he says, is from chain stores that sell new cells. Many old cells are discarded there and thrown in the waste. They can be picked up cheaply. Power for recharging can be taken from an automobile storage battery or the increasingly popular wind-mill generator.

A MONEY-MAKING

idea

I Raise CATS Under Water



Not only are bewhiskered catfish good eating—they're good business as well.

Mechanix Illustrated
February, 1951

By P. H. Hill
as told to Gordon L'Allemand

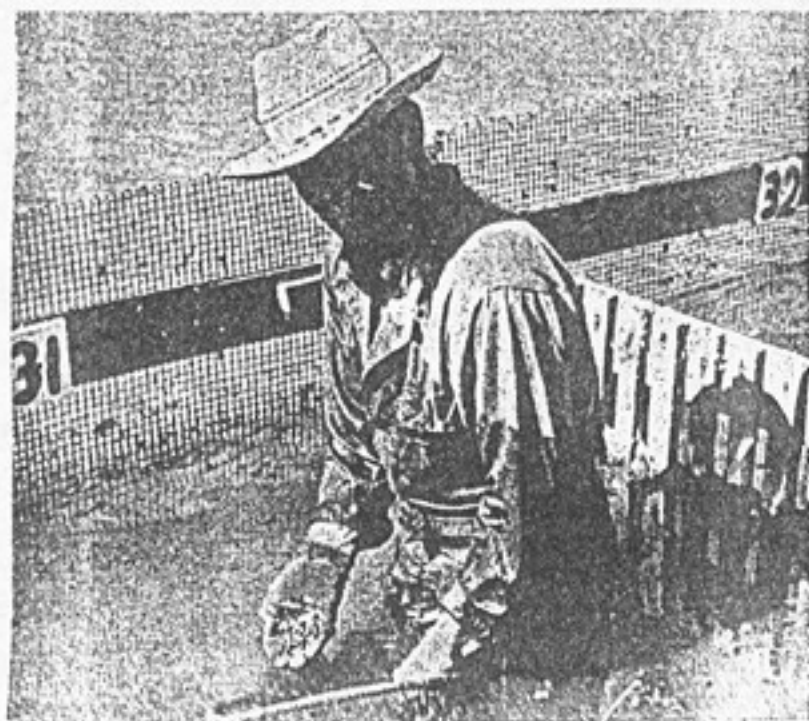
ON a 640 acre farm in Arizona, I run the only commercial catfish-raising plant of its kind in the world. How did I, an auto dealer in Abilene, Tex., get started in this strange business?

Well, two years ago my friend Marcus Harwell drove out to California and Arizona and came back bubbling over with fish-farm plans. He had seen the fabulously rich flat delta of the Colorado river below Boulder Dam—hundreds of miles of flat land, bountiful water, no more dangers of flooding.

Marcus' enthusiasm led us to drive out and look over the layout. We found rich

brush-covered land on the Mojave Indian Reservation. It had never known the plow—only coyotes, deer, wild horses, burros and Indians. We conferred with the Reservation authorities and they looked favorably upon a long-time lease.

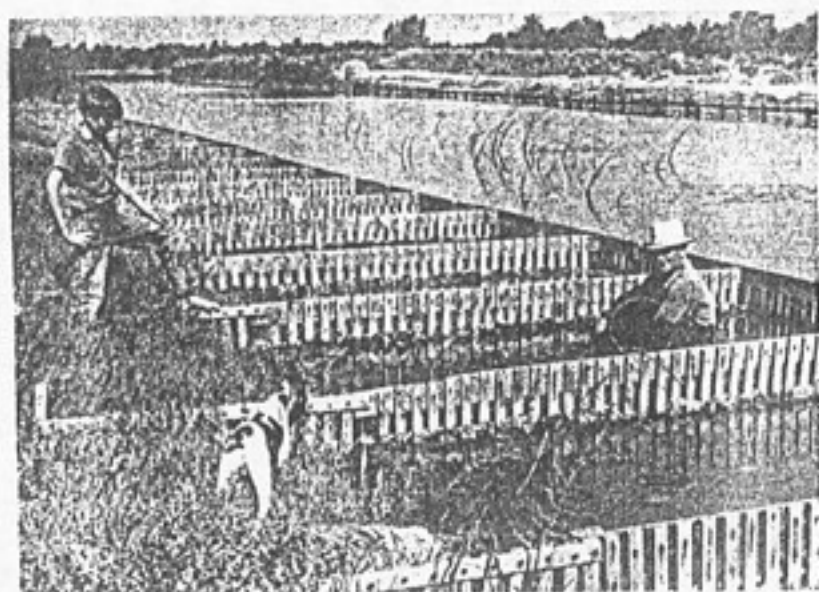
So, in March, 1949 we started laying out plans for 60 ten-acre lakes, several three-acre culture ponds and two half-acre spawning ponds for 100-pair catfish breeding pens. We laid out canals, put in piping and pumps, built our administration center and put in a foundation for the large frozen-food-locker plant we were later to buy and install. We were too late to get started for



Head catfish expert Ernest Pockrus, above, examines a handful of egg spawn and bottom mud. Below, he checks the spawning can in a breeders pond. Center pool is year-round home of the cats.



Algae and fertilizer in foreground of spawning pond, above, sink to bottom and become food. Below left, Pockrus holds a female brooder while his youthful helper Charlie White holds the male.



the 1949 Spring spawning season—but we prepared for 1950.

Now we have 12 of the ten-acre lakes constructed and filled with eight feet of water. Each of ten of these holds 12,500 six-inch channel catfish fingerlings from our early 1950 Spring spawn hatch. We have acquired 150 pair of fine stock channel catfish weighing 4 to 16 pounds each. They cost us \$1 a pound and now we wouldn't sell them for \$10 a pound.

Is there really a market for fresh and frozen catfish? The channel catfish is the tastiest fish I know—and that includes trout. Of the three United States varieties—channel, blue, and yellow—the channel is by far the best flavored and has the firmest meat. Some 18,000,000 pounds of wild catfish are marketed yearly in the United States. Caught in Texas, Florida and Louisiana they are sold in Eastern, Southern and Western markets.

I have orders on my desk from Los Angeles fish wholesalers for four tons of fresh catfish a week. We believe that the Los Angeles market alone can absorb twice our 1952 planned million-pound output.

A nationally known frozen-foods corporation also has offered to take our entire planned annual output. We will probably operate through them but have been holding off to study the fresh and frozen-fish markets. It takes a year for catfish to reach the desirable market size of three-fourths to a pound-and-a-half. We will have our first fish to sell in the late Spring of this year.

Raising catfish is reasonably easy if you know the habits of the fish. You can raise them commercially or for farm food fish in most of the United States except in high mountain country with cold water. Main trick is to mate your pairs. Four to six pounders are the

best weight. The females will lay 15-25,000 eggs in a batch.

Always choose channel cat males a little larger than the females for the male hatches the eggs. If he were smaller than the female she would fight him off and eat the eggs. Place a nail keg or a ten-gallon milk can in the deepest water of each pen. The fish deposit their eggs in these. Brooders will improve with age and tameness, many spawning up to ten years of age.

We now have 300 brooders weighing 4 to 16 pounds each to which we feed 200 pounds of chopped horse or carp meat once a week. That and the natural feed in the ponds completes their diet.

Interestingly enough, growing catfish soon learn to know their friends, recognize familiar footsteps and can be called like chickens by banging a feed can. At the approach of strangers they come to the surface warily.

Getting spiked by the spines of a big catfish is a rather painful experience. Ernie Pockrus, my head fish man, has been spiked many times through the years. But he laughs when he tells about a time last Spring when he got his worst spiking.

"It happened like this. We run one pair of catfish brooders to a 5x7-foot pen. The

water is three feet at the end and slants up to nothing on the grassy shore side. The bottom is mud and slick footing. A kid helping me had put an extra pair of big 16-pound catfish brooders into pen No. 12 and I didn't know until too late. I'm in there in the deep end reaching deep in the water for the steel egg can.

"Suddenly I move my foot and a cat spikes my ankle. I jump, lose my balance and fall over backwards into the shallow end. Man, I must have sat right down on all four catfish. And they were plenty mad. Three spikes stuck into my rear and I let out a yell.

"It wasn't fatal—but a catfish spine wound feels about like a bee sting increased in proportion and I was sore for several days. First thing I did was put a set of cleats on my soles."

Do we eat channel catfish? Man, and how! I'm from Texas, and we Southerners know good food—and good fish. Here's my recipe for cooking channel catfish; take nice meaty pieces, wash, dry, salt and pepper to taste. Roll in plenty of corn meal, then fry in deep hot fat until the pieces float golden brown. There you have eating fit for the gods. Yes, you'll wind up with a stomachful of fine fish and at the same time keep my pockets full of cash. •

by William H. Osborne

Mechanix Illustrated

January, 1953

His Fish Are His Fortune



Fishermen, and girls, can catch all the trout they want, for \$1.25 a pound. They are brought to Honeyman for weighing.

STRANGERS driving on U. S. Highway 30, eight miles west of Portland, Oregon, hit the brake when they see a sign, Trout Fishing, Rainbow Lake. Many of them stop to fish and together with people who are familiar with the place, they put many thousands of dollars each year into the cash register of Bill Honeyman's trout farm.

Honeyman has found a way to keep fishermen honest and make a good living for himself at the same time. Now when a local trout angler goes out and fishes all day in vain he can stop by Rainbow Lake on the way home and easily take a limit of big ones. And he won't be lying to the little woman when he swears he caught them . . . at \$1.25 a pound. Unlike other farmers Honeyman doesn't have to pay harvest hands. His customers do the harvesting and pay him for the privilege.

Bill Honeyman, hardware clerk in 1937, had saved \$500 and decided he was ready to go into business. He talked over the idea with his wife, Dorothy.

"What kind of business can a man buy with \$500?" she asked.

Bill was rather sheepish about his idea but finally blurted out the opinion that a fish farm would be a good business for them.

"But where can you buy a farm with only \$500 down?" she asked again.

Bill had to admit that he didn't know. He thought they should start looking around. From that time on all their Sundays and holidays were spent scouting the countryside for a place that had the makings of a fish farm and could be purchased on their terms.

After several months they located 51 acres of logged-off land which was choked with brush intermingled with second-growth fir and alder. One thousand feet fronted on U. S. Highway 30. Three springs on the upper reaches of the place converged into a small creek flowing through a 14-acre basin just above the highway. Walking down the little creek Bill noticed a small trout scurry for cover. The creek had to be trout water.

He followed the little stream down to the road. Highway 30 had been realigned at this point to straighten out a slight curve. An underpass for cattle through which the little creek flowed was left intact when the old road bed was abandoned. The new highway fill nearly paralleled the old only 60 feet north.

The old road bed appeared sturdy enough for a dam. It was 16 feet

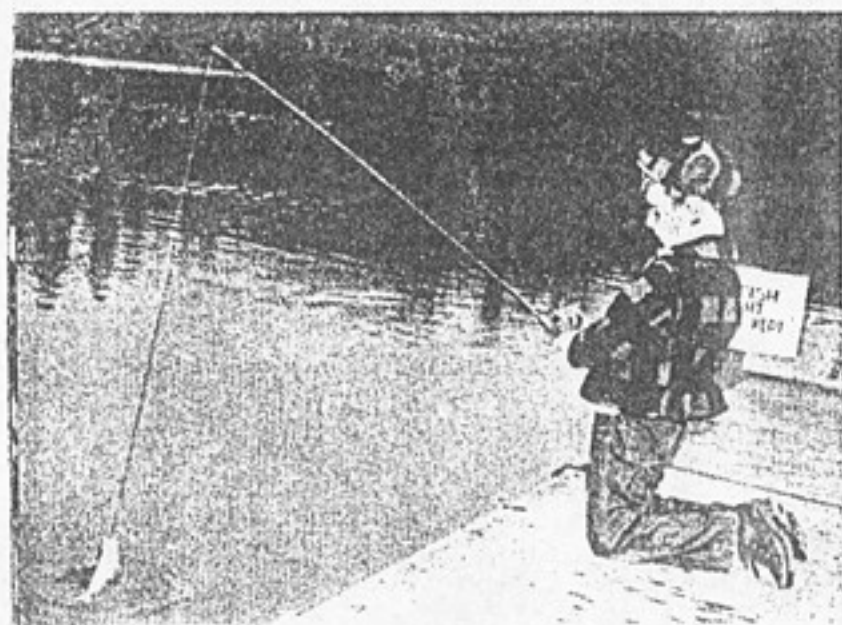


When trout are biting, it doesn't take long to fill a creel. This young lady caught six nice ones in less than two hours.



Bill and Dorothy Honeyman stand before the fireplace in their Rainbow Lake Lodge. Their service to fishermen netted them \$12,000 last year.

Children whose fathers are trout lovers are steady customers. There's nothing like breaking in a boy where trout are many and hungry.



thought a few sheep might help to clean up the creek basin. He purchased 12 sheep and they removed more vegetation from the area than he and his wife had done. When it came time to market the first crop of wool the sheep helped finance the project, for wool brought \$1.25 a pound that year. A dozen sheep still graze around the head of the lake and add to the income.

The hatchery had a capacity of 300,000 eggs. The first batch of eggs was purchased from a commercial hatchery in Montana. Trout eggs hatch in three weeks at 52 degrees temperature and the temperature in Rainbow Lake is 52 degrees most of the year. Mortality rate of young trout fry is usually heavy except under the most ideal hatchery conditions. But Honeyman managed to save about 90 per cent of the hatch and since the lake was virgin water for aquatic organisms on which the trout feed, they grew fast. One year after the first eggs were hatched Honeyman estimated that

in height from the creek bed. By using the culvert as a spillway the cost of completing the dam would be negligible. By filling in the 60-foot space between the old and new highway an access to the dam and a parking lot could be built. A more perfect setup for what Honeyman had in mind could not be found.

Even before checking with the highway commission to see if he could obtain permission to construct a dam, Honeyman approached the owner of the property. Yes, it could be bought for \$2500 and a \$500 down payment would be acceptable. Honeyman didn't waste time arguing about the price. He plunked down his money and hurried to the highway commission.

The highway commission gave him a permit to dam the creek providing their engineer could check for seepage each time the water level rose a foot.

Honeyman then hurried to the State Fish Commission. In most states it is necessary to get permission to build dams on streams which are potential fish-spawning areas. This creek was considered too small for salmon spawning and the permit was granted.

Clearing the creek basin with crude implements at night by lantern and on week ends was a slow job. Honeyman talked some of the neighboring farmers into lending him earth-moving equipment which helped speed the work. He still kept his job in the hardware store. By this process it took two years to get the basin cleared and filled with water.

Meanwhile he built a crude trout hatchery at the upper end of the lake and a freezing plant to store food for the trout.

Honeyman

100,000 trout ranging in size from eight to 12 inches long were ready to harvest.

He first opened the lake for public fishing during the months of March, April, May and June. He could not raise enough fish to keep the lake open the year around. Later additional hatchery facilities were constructed and arrangements made to purchase fry from a commercial hatchery to augment his stock. The lake is now open for business the entire year and even on stormy, wintry days there are enough paying visitors to maintain a profitable operation.

The lake was a financial success almost immediately. Honeyman charged customers \$1.25 a pound for all the fish they could catch—and they always caught more fish than they intended to. Honeyman realized that his sales training as a retail clerk was of no value in this business. People didn't have to be sold on fishing. Customers could bring their own rods or rent outfits from Honeyman for 25

cents. They could bring their own bait or purchase it at the lake.

There were many problems the fish farmer had to solve. Predators of several varieties had also discovered the lake and they were not paying customers. Bull frogs, native to the Columbia river swamps, found the lake ideal living quarters. They compete with the trout for food and even consider the small trout part of their meat supply. They got into the hatchery and holding ponds and gorged themselves with trout fry. It was necessary to cover the hatchery troughs and ponds with wire mesh to keep them out.

It also was necessary to take steps to reduce their population. Since there were several restaurants nearby which purchased frog legs for their menus they had a commercial value. He found that he could control the frog population by rowing around the lake and dipping out most of the frog spawn each spring. Although other fish such as bass, crappie and bluegill feed on tadpoles, trout apparently consider them unfit to eat.

Other predators more easily controlled were fish ducks, otters, mink and raccoon. A western species of water snake, quite rare in the lower Columbia River Basin, decided the lake was home for them also. They were brought under control by rowing around the edge of the lake on hot days and shooting them with a .22 rifle while they sunned themselves on the bank.

Certain song birds also like young trout fry. The Honeyman's wonder if there is any other form of life upon which so many animals feed as the delectable rainbow trout.

Last year Honeyman's annual income was nearly \$12,000. At Rainbow Lake clubhouse, located on the fishing dock, dinners are served from the regular menu or customers can have their freshly caught trout fried crisp and brown, served with cole slaw, french fries, coffee and hot garlic rolls. Rental income from frozen-food lockers, miscellaneous sales such as sandwiches, coffee, soft drinks, cigarettes and beer help build up the profits.

Although fish farming is not an entirely new idea it offers excellent opportunities for the man who likes outdoor life to get into a profitable business with a small investment. Land suitable for a fish farm is generally unsuited for other types of farming and can be bought for a fraction of the price of good farm land. Competition is now practically nonexistent for the fish farmer.

All parts of the country are not naturally suited to trout raising but some species of game fish such as bass, bluegill and crappie can be raised in several sections of the country. The U. S. Department of Agriculture has a publication entitled *Farm Fishponds* (Farmers' Bulletin No. 1983) which gives complete information on the construction and maintenance of small fish ponds for profit and recreation. Another U. S. Department of Agriculture pamphlet entitled *Techniques of Fishpond Management* (Miscellaneous Publication No. 528) contains practical information on raising warm-water game fish. State conservation departments and local county agents can advise which species of fish are most adaptable to individual localities. •

Animated Monkey Slides Down Pole to Amuse Small Children

Watching the monkey literally "jump" down the pole will amuse youngsters by the hour. The toy is made from a 1/4-in. dowel, a length of stiff wire and a wooden

cutout of a monkey. A portion of wire is formed into a coil spring by winding it around a 5/16-in. metal rod. Wound over a form of this size, the spring will be a loose fit on the dowel. The cutout is attached to the projecting end of the wire, and a wooden block serves as a base to support the pole vertically. To operate the toy, place the coiled end of the spring supporting the monkey over the top of the pole, give the monkey's head a flip to set up a vibration and he will slide down the pole in a very realistic manner.





He Popped Corn Into a Fortune

From buying furs to selling popcorn was quite a jump for Clyde Gould. But he made it—and sales are really popping.

By Bruce Morgan

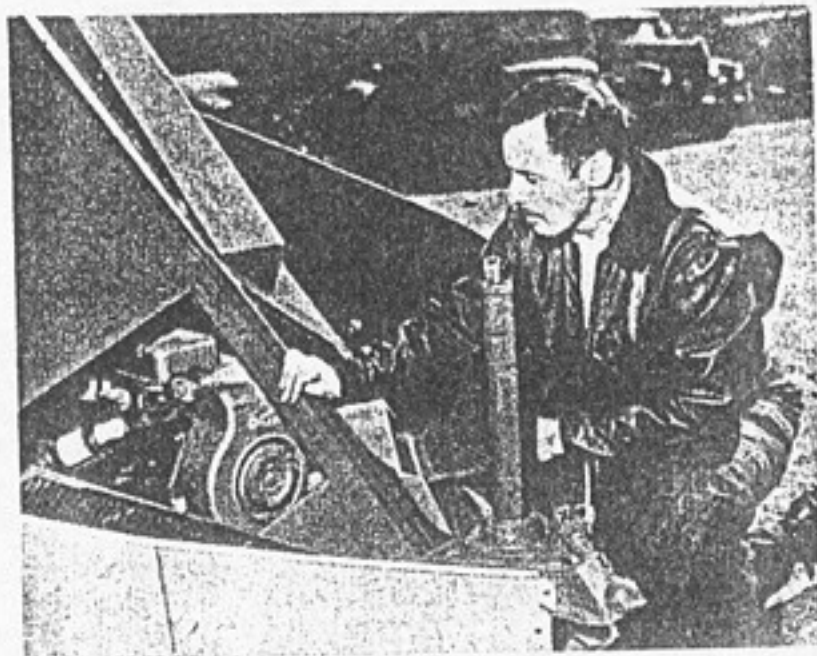
Mechanix Illustrated
November, 1953

Gould's Robin Hood Popcorn Unit, seven of which are now in operation. Design is his own. He made the first unit himself as model for manufacturer.

CLYDE "Blackie" Gould, a 30-year-old Minneapolis man, had always been nuts about popcorn. Like millions of others, he ate the stuff in theaters, at fairs and sports events and he saw so much corn popping wherever he went that he felt it might be an easy way to make money. As a result he came up with a brand new idea for selling popcorn and in the first year his cash register played such a pleasing tune to the accompaniment of popping corn that his idea is destined to turn into a nationwide bonanza.

It all started in 1951. Gould, a former Navy flier, was earning a nice living as a fur buyer. From his wages he had managed to put aside a nest egg of several thousand dollars. His main ambition, though, was to own his own business. He thought about operating a newsstand or a cigar store but that meant long hours and short profits and he began to look around for something that moved fast—something that could be sold anytime, anyplace.

When he learned that the nation's movie



The Onan Generator in each unit works by small gasoline engine, supplies electric power not only for lighting fixtures but also corn popper.



A Jeep panel truck takes over the towing job for each trailer and pulls it to the most desirable location. It also serves as its supply runner.



Each trailer has an electric Kloster popcorn machine, mixers and a heated butter dispenser. Gould says good butter is extremely important.

theaters virtually were kept in business as a result of their terrific popcorn sales, Gould exclaimed: "Boy, that's for me!"

A care-free, fun-loving individual, Gould told friends about his desire to sell popcorn. That posed a problem. They thought that he was wacky to even consider such an idea. Others said that he must be off his rocker because he wasn't the kind of character to tie himself up with popcorn. But he was serious. Despite the ribbing from his friends, he went ahead with his "crazy" plan.

Gould figured that if you could sell average, unbuttered popcorn for a dime (due to the high price of butter most vendors were not using it) you could sell top-grade, hull-less corn doused with delicious, pure creamery butter for 15 cents or 25 cents for a giant box.

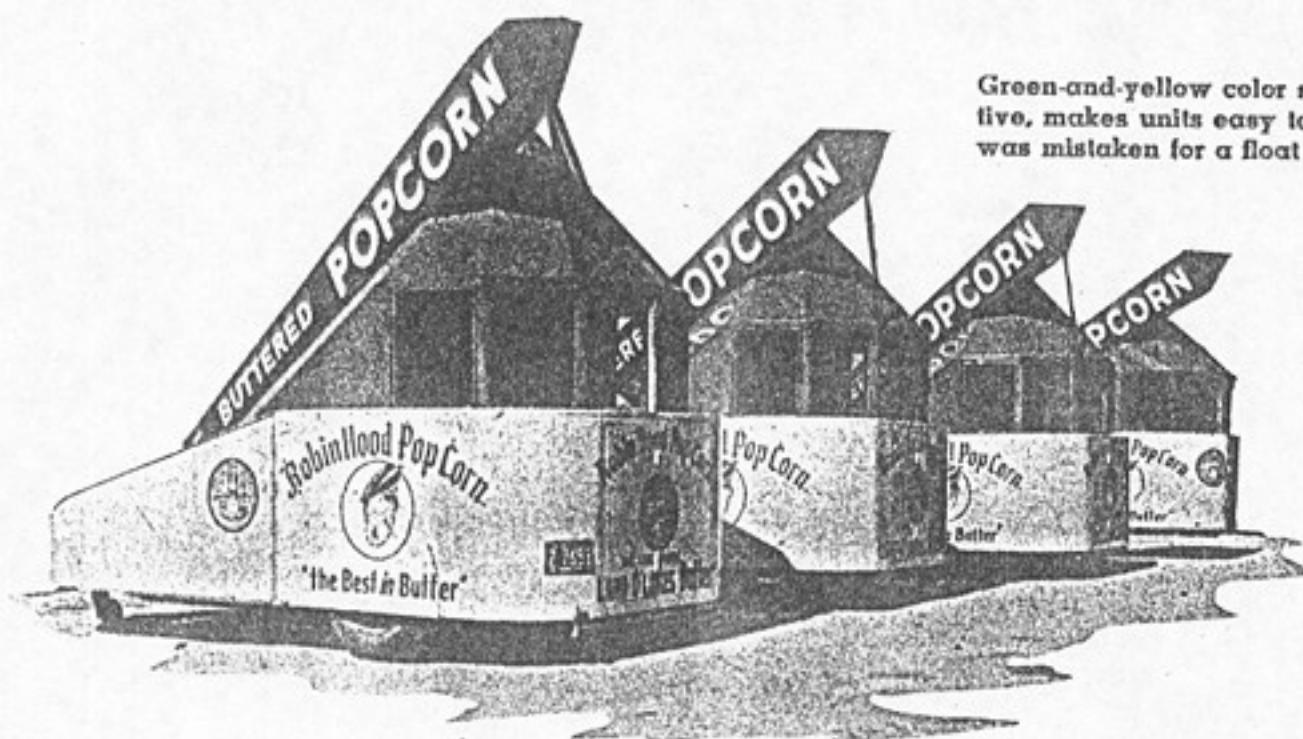
His problem, however, was how to get the stuff to the public. He could set up a store or a stand for some big event but in a few days or hours the event was over and so were the crowds.

"Why not take my product directly to

the public?" he reasoned. The big question remaining then was "how?" Finally he came up with the idea of taking the legendary figure of Robin Hood as his trademark. He named the product "Robin Hood Popcorn" and designed a small, maneuverable trailer dispensing unit in the shape of Robin Hood's feathered cap. This could be shifted and set up easily wherever there were crowds—at fairs, community functions and other events—by towing it behind a jeep panel truck. He tried to get a unit built by several different manufacturers but finally had to build one himself. He did a good job, too.

Next, he made an agreement with Land-O-Lakes Creamery whose extensive operation and heavy advertising of Land-O-Lakes Creamery Butter is known throughout the country. Thus he removed any suspicion on the part of the customers that anything but pure creamery butter was being used in the product.

In the beginning Gould was beset by a number of problems, some of them rather humorous. Like the time he was testing



Green-and-yellow color scheme is attractive, makes units easy to spot. Once one was mistaken for a float at local parade.

popcorn brands. He found that, strangely enough, the corn he popped didn't have the same taste as the stuff he purchased at other stands. Then one day he discovered the reason. He smoked cigars almost continually and in the confined area of the wagon the smoke was making the corn taste odd.

Then his butter posed an awkward situation. He had to buy it in large quantities to get it at a reasonable price and had no place to store it except in his home. This he did but the stumbling block was—he was allergic to butter!

Finally Gould made a test run with his unit at a neighboring town. When people got a look at the wagon they began to rib him but when he anchored his rig on location, he was swamped with customers. He had to break up the crowd. Kids bought popcorn for blocks while he was still moving. That convinced him.

Quickly he built a total of seven wagons. Two jeeps were used for towing the trailers and for keeping the units supplied with butter, corn, change and collecting proceeds.

One time during the Aquatennial Parade, Gould was selling popcorn in his colorful little rig when he received a terrific dressing-down from an exasperated official who thought the popcorn wagon was one of the floats that had strayed off parade limits. Gould soon convinced the official that he didn't belong in the parade when he handed him a free sample box of his product. "The guy licked his chops," said Gould, "after eating the corn. He bought a handful of boxes to take home to his family."

Gould's popcorn stands are a far cry

from the conventional popcorn wagon which through the years has become such a familiar part of the American scene. Where earlier vintage outfits were always painted white, these have an effective and dazzling green-and-yellow color scheme, making them easy to spot. The 15-foot red "feather," set at a rakish angle, points skyward and beckons the customers. An important advantage is that these outfits set low on the ground, almost at street level, thus expediting service and making it easy for the small fry to step up and buy.

For business after dark, the Robin Hood setups feature bright, colorful lighting arrangements. Instead of the glaring gasoline lamps, modern fixtures with bright interior and indirect exterior lighting are used. This is made possible by a small, compact, economical electric generating plant driven by an air-cooled gasoline engine. It's an Onan Generator which produces 750 watts of AC power at a cost of but a few cents an hour. Gould chose these for his trailers because of their compact size, efficient operation and low initial cost. Each is mounted at the base of the "cap," which is at the front end.

Many people became interested in the Robin Hood wagons and Gould decided to franchise his successful brainchild. With each franchise he will furnish a complete working unit and set up a supply system. Wagons cost \$1500 but can be easily financed. An operator can realize about \$100 gross a day from a single unit in the right location. Units can be worked summer and winter. Gould says that he has been operating continually in Minneapolis and in certain locations December has been his biggest month. •

HOUSEKEEPER FOR A *Million Frogs*

Ball-playing frog is not actually playing a game of catch. He's just hungry. Frogs try to eat anything that looks alive and will refuse even the tastiest food if it's motionless.



POPULAR MECHANICS
JANUARY 1951

By Ewart Thomas

THERE isn't a main-line railroad within miles of Harold Lee's frog farm and yet on a summer evening you'd swear that a couple of diesel locomotives were rushing past the front door. "A million frogs can make a lot of noise," Lee says.

Counting tadpoles, Lee possibly does own that many frogs. In any event, he's one of the few men who have made a success of raising them commercially. At his five-acre froggery near Ventura, Calif., he has thousands of grown frogs that are ready for the market and tens of thousands of tadpoles that either will be eaten by the big frogs or that will grow up to be frogs themselves. Lee counts on a good percentage being used as food.

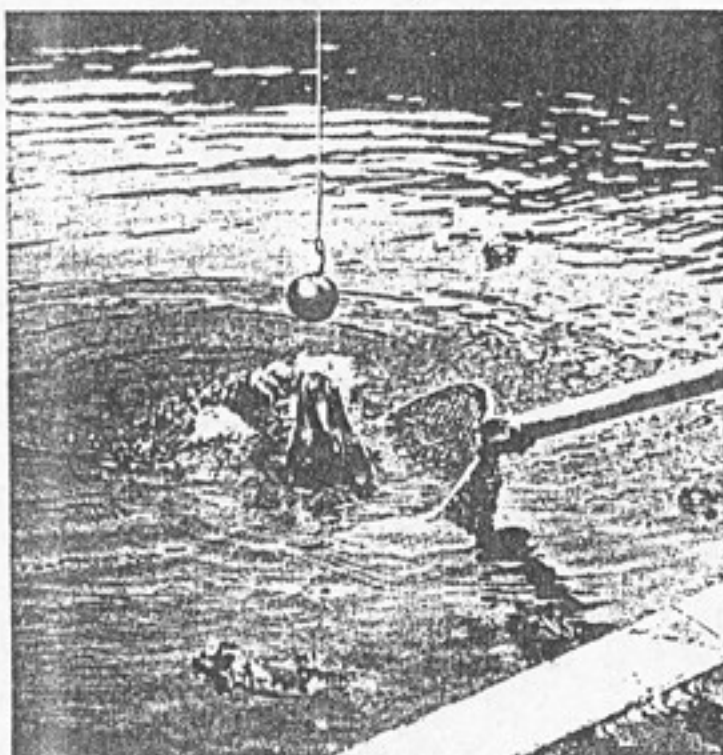
Frog meat is an expensive delicacy that compares somewhat with chicken or turkey in flavor. There never has been enough of it on the market to satisfy the demand. Much of the available meat is shipped here from abroad; some frogs are obtained for the market by hunters, who spear them after dark in the swamps of Louisiana and other Southern states.

Literally hundreds of people have tried raising frogs commercially but the history of frog farming has been very disappointing. Many who have tried it have concluded that frogs don't mature successfully except in the wild state. A

Harold Lee uses a long-handled net to catch frogs in pond with a jungle setting which protects them when they leave the water



Lee got this frog to pose for his picture before leaving for market. He will yield about ½ pound of meat. Below, rubber ball dangled above water attracts frogs from all directions. Moving objects are food to them



few men, however, seem to have found the secret of high production and Lee is one of them. He'll talk volubly about many of his problems but there is some knowledge that he won't give away.

He developed his present "domesticated" strain from giant wild American bullfrogs. These grow to large size in two years. Lee keeps his amphibious little animals in a group of artificial ponds and pools that consist of large shallow concrete tanks. In all, he has 150,000 square feet of water area and the pools are fed by well water. The overflow from the pools is used to irrigate his fruit orchard. Water hyacinths and other aquatic plants grow on the surface of the pools and there are jungles of pussy willows and other shrubs along the borders.

When you inspect one of the pools in the middle of the day, there may not be a frog in sight. Lee brings them to the surface by dabbling the water with a small rubber ball at the end of a line that is tied to a fish pole. Frogs gather around in a rush, jumping and striking at the ball.

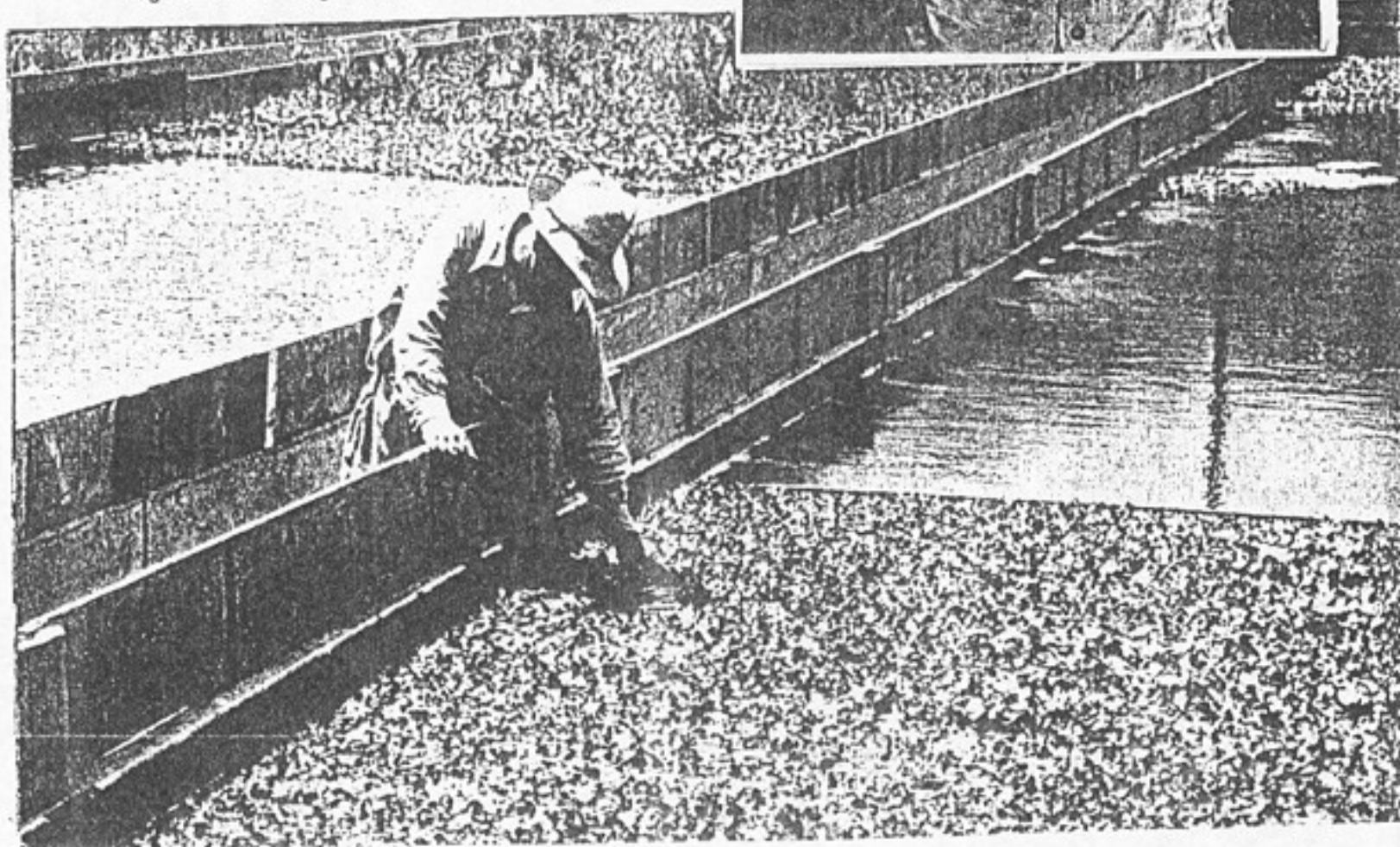
"They think it's something to eat," he explains as he deftly slips a long-handled net under a big one. "Frogs won't eat any food that isn't moving and they'll try to eat anything that is in motion." In five minutes he captures a dozen frogs and in another quarter of an hour he has them dressed and skinned for a customer. A good-sized frog yields up to half a pound of meat and the meat sells for \$1.85 a pound. Lee also sells quite a number of mature live frogs that are to be used as breeders.

Live frog food, consisting of crayfish, small goldfish and minnows, is raised in long tanks. Fish eat vegetation so frog farm is virtually self-supporting

Frogs of market size live in walled ponds from which they can't escape. Smaller frogs have separate ponds and the various sizes of tadpoles are kept in still other tanks. Frogs are cannibalistic and it's best to segregate them according to size.

Eggs and tadpoles have a host of hungry enemies and, in the wild state, only a few score frogs may grow from each spawning that contains 10,000 eggs or more. Lee estimates that he has just about reversed this proportion. If he didn't use most of the tadpoles as food he'd have more frogs than one man and a helper could handle.

Lee holds a typical two-year-old specimen raised on his farm. Big frogs that are now raised commercially yield considerably more than meat from hind legs





Lee inspects exhaust stack from underwater heater he designed to warm an outdoor pool for tadpoles

Frogs spawn in the summer and the eggs are found floating on the water. Lee transfers the masses of fertilized eggs to the tanks of a special indoor hatchery where he keeps the water temperature at just the proper degree and where the water is agitated by the sprays and drips that leak continually from a bank of overhead pipes.

When tiny tadpoles hatch from the eggs, they are kept indoors for a time and then are transferred to out-of-door ponds. One of the outdoor tadpole tanks is heated in cold weather by a gas burner that is built into its foundation.

The reason most people who try to raise frogs fail is because they do not provide the right foods, especially for the little tadpoles. Lee's early losses were almost 100 percent. Finally, he built a glass-bottomed "look box" and spent days watching tadpoles in a swamp to find out what they were eating. He studied the feeding habits of larger tadpoles by placing a few of them in a glass-walled aquarium.

Mature frogs simply won't touch inanimate food and so Lee first tried to feed them with small pieces of meat that he dabbled in the water at the end of a string. That worked all right, but he was spending all of his time at the chore. Now he uses live foods similar to those found in the swamps and rivers. Besides tadpoles, frogs also thrive on crayfish, small goldfish and minnows.

Lee raises small fish in several tanks that he uses as hatcheries. He seines out the fish at need and transfers them to one of the frog pools. Similarly, he breeds crayfish. The crayfish and minnows eat the vegetation that grows in the tanks and so the frog farm is self-supporting with hardly a cent being spent for food or supplies. "I just sit back and watch my frogs grow to market size," the proprietor says.

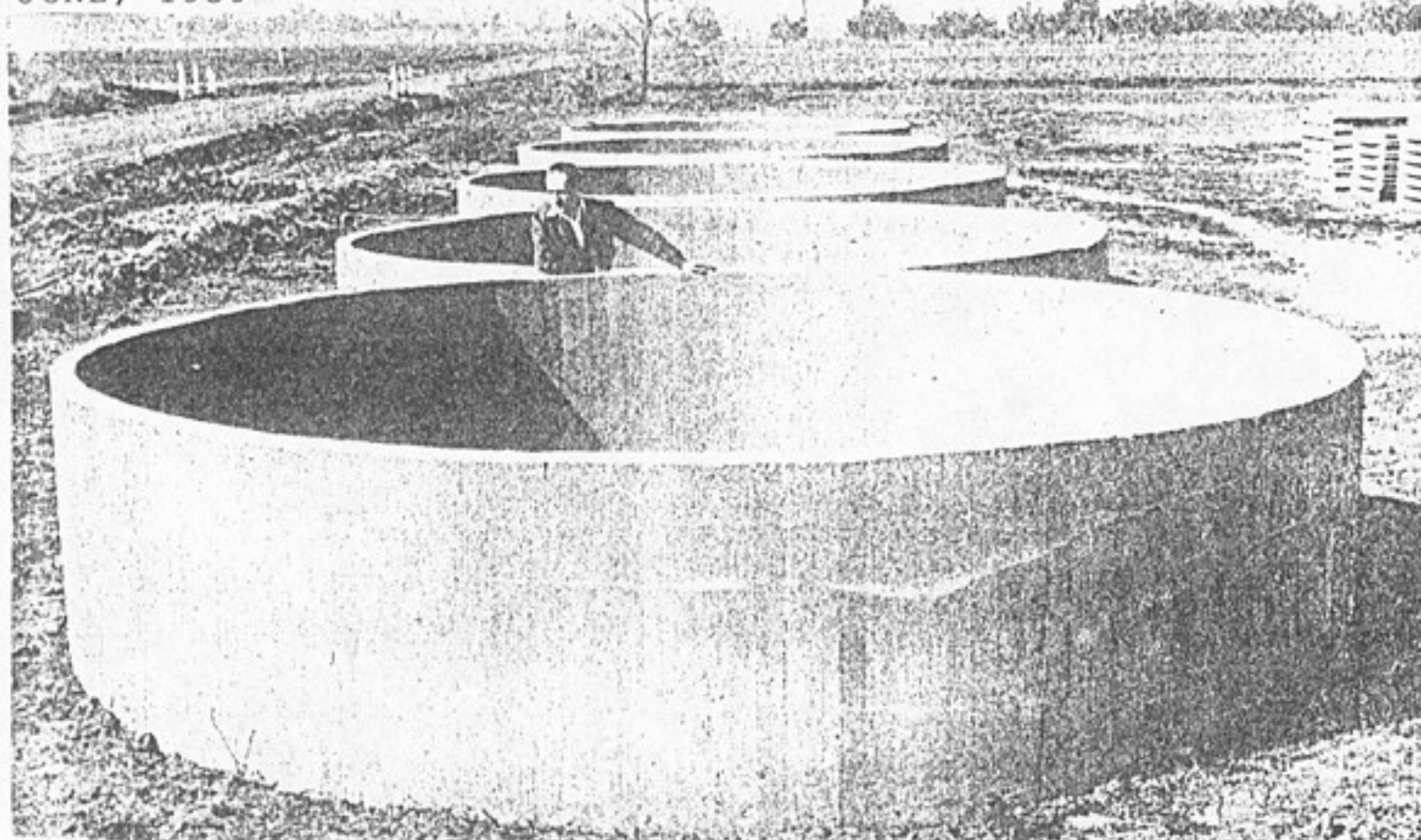


When frogs get used to a person they tame easily, Lee says as he sits down among some of his prize specimens. He has worked with frogs since he was 15



Wire trap is lowered into a hyacinth-covered pool inhabited only by crayfish, a favorite frog delicacy. Live food is the secret of running frog farm

Mechanix Illustrated
JUNE, 1939



Tanks Simplify Bullfrog Culture

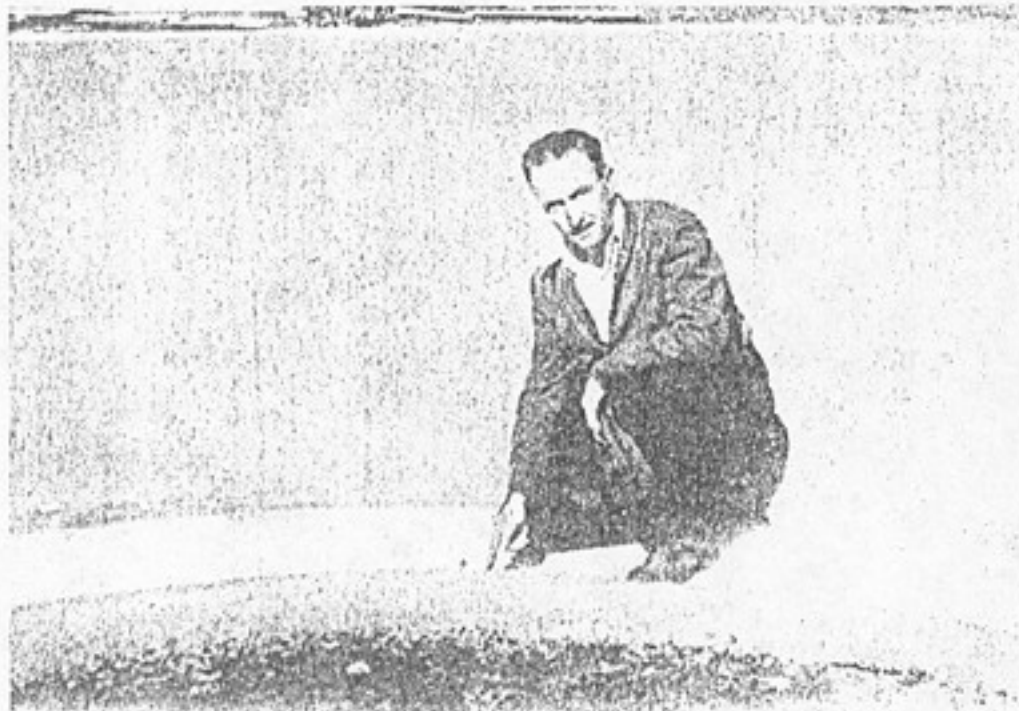
COMPLETE protection against all natural enemies, perpetual shade, adequate feeding, abolition of cannibalism, elimination of red leg frog disease, ideal temperature control, confinement of frogs to the domestic range, greatly reduced mortality and a growing time of seven months from baby frogs to marketable maturity are some of the many advantages claimed for a patented system of frog culture in concrete tanks developed by John Eugene Stearns of El Monte, California.

In 1932, Stearns began experimenting with the idea of raising frogs in concrete tanks, 4-feet deep and 16 feet in diameter, 1,000 frogs to each tank. The first year proved the basic success of his plan; he raised 4,000 out of 5,000 frogs placed in a series of 5 tanks—a mortality of only 20 per cent. By 1937 he

Above—A bullfrog tank farm. Each tank is 16 feet in diameter and holds 1,000 frogs.



Right—Inside one of the frog tanks, showing the concrete lip on which the frogs spend most of their time. The man is indicating the 2-inch-high flange which marks the normal water level maintained in tank. Center—Imagine what happens when 100 pounds of earthworms, crayfish, etc., are placed in the lip with 1,000 "big fellows" like these.



succeeded in improving the mechanical operation of the tanks and raised nearly all of 7,000 frogs placed in seven tanks immediately after transformation from the tadpole stage. Not only had he reduced mortality almost to the vanishing point, but produced bullfrogs 20 to 22 inches in length overall, marketable frogs weighing three to three and one-half pounds each, in the record time of seven months! With such frogs worth half a dollar each in Los Angeles markets that call for thousands while he could deliver only by hundreds, Stearns moved to Los Angeles County and is now engaged in setting up the Parker and Stearns Frog Farm near El Monte. As these lines are written only five tanks have been completed toward the ultimate goal of 100, with a production of 100,000 marketable frogs every seven months. In addition to that income Stearns is apparently destined to receive some handsome patent royalties accruing from the use of his tanks and methods by frog farms in all parts of the nation.

Under the Stearns system of bullfrog culture propagation follows most of the common practices of the last thirty or forty years up to the point of tadpole transformation. There are the usual spawning pools for breeders, tadpole ponds and food culture ponds for raising the living food required by frogs of all ages. Beyond the tadpole stage, however, the tank system comes into play as a radical departure from methods previously used by frog farmers.

Baby frogs are carefully matched for size and placed 1,000 each in the series of tanks. Except for a concrete lip, 24-inches wide encircling the bottom inside the tank, 16-feet in diameter, the entire base of the tank is open. The frogs, it is claimed, derive certain benefits from this contact with the earth.

This arrangement also creates a round, earth-lined pool, 18-inches deep and 12-feet in diameter at the bottom of the tank.

By maintaining the water level at this depth in the center pool two inches of water is kept over the concrete lip. Since the frogs spend most of their time on the lip this depth of water creates the condition that frogs seem to like—the ability to sit with their bodies partially submerged.

The center pool is equipped with a four-inch

drain pipe controlled by a valve outside the tank. Prior to feeding, an operation that is done only twice each week, approximately 100 pounds of live frog food (carp minnows, goldfish, large earthworms and crayfish seined from the food culture pools—or taken from the earthworm culture beds in the case of earthworms) are liberated into the tank. It is the natural instinct of these creatures to move toward the wall of the tank. The drain valve is then opened and the water lowered to a depth of about two inches in the center pool. A series of small perforations in the flange of the concrete lip causes the water to drain from the lip completely. This leaves the living frog food "drydocked" on the lip—earthworms and crayfish crawling about and minnows flapping, completely at the mercy of the frogs. When this happens the scene inside the tank is one of tremendous activity—frogs jumping in all directions gorging themselves upon their helpless living prey. In a few minutes the 1,000 frogs obliterate every trace of the living food. The normal water level is then restored.

The feeding operation also serves to make a thorough cleansing of the tank—frog excrement and other contaminations of the water being removed through the drain pipe when the water is lowered. Restoration of the normal water level replenishes the tank with pure water softened by having been put through a water-softening system. It is to this cleansing feature of the tank system of culture that Stearns attributes the complete freedom from disease of his tank-raised frogs—no red leg, the disease that has ruined many a frog farmer—mortality from any cause reduced to negligibility.

Frog tanks such as those depicted in the accompanying photos can be built for about \$50 each, including the shed roof and all necessary fittings. That cost seems very nominal when weighed against the inventor's accomplished demonstrations of a production of approximately \$500 worth of frogs from each tank every seven months. The tank system of frog culture is essentially a mechanical method of accomplishing what successful frog farmers in Japan have long been doing with costly and elaborate equipment and endless hand labor.

Frog Calling Device Imitates Bellow and Grunt of Bullfrog

MODERN MECHANIX

October, 1935

RUBBER reeds mounted in a simple sound box can be made to imitate the deep, sonorous bellow of the giant bullfrog. With a little practice you can imitate the sonorous bass of the mating "song," stimulating other frogs to answer.

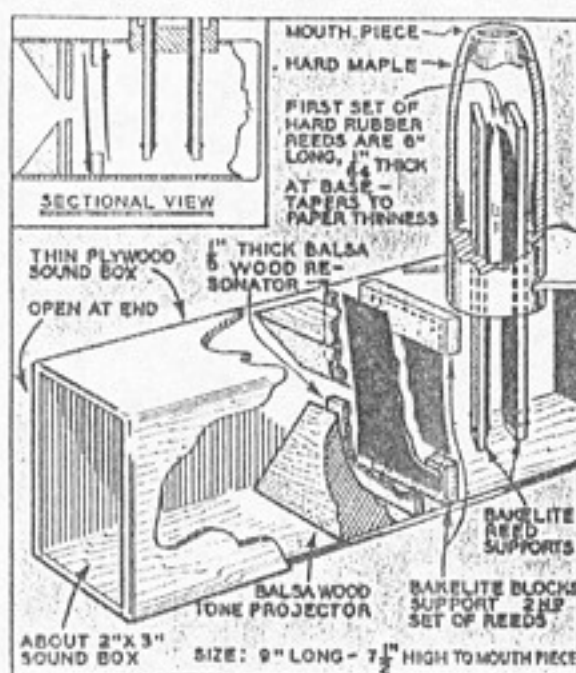
The bullfrog call is very useful in locating the largest frogs in

rearing ponds on those dull or cloudy days or nights when frogs seldom bellow. One of the units has even been used by a California frog farmer to lure poachers away from an outside fence, to a point where they could be surrounded and caught with evidence of their guilt. In Hollywood these calls have added the necessary sound

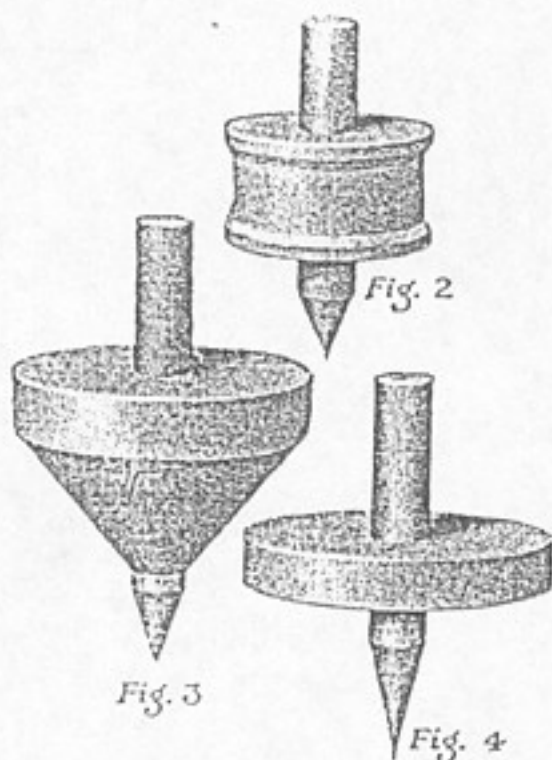
atmosphere to marsh and swamp scenes.

Essential construction features are given in the sketches, but some experimentation with the reeds and the sound box

may be necessary to obtain the exact sound required. The user blows gently into the hard maple mouthpiece, modulating the tones with tongue to get a "Chug-O-Rum" sound.



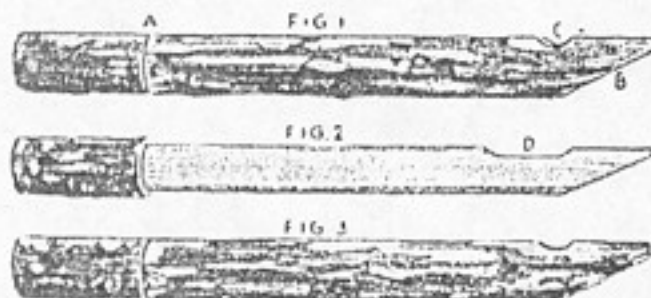
Believed to be the first device ever made which accurately imitates the hellow and grunt of the American bullfrog, this glorified harmonica has been used successfully by a frog farmer to stimulate frogs to "song" for the amusement of visitors. The inventor believes it should prove valuable to frog hunters who catch wild frogs.

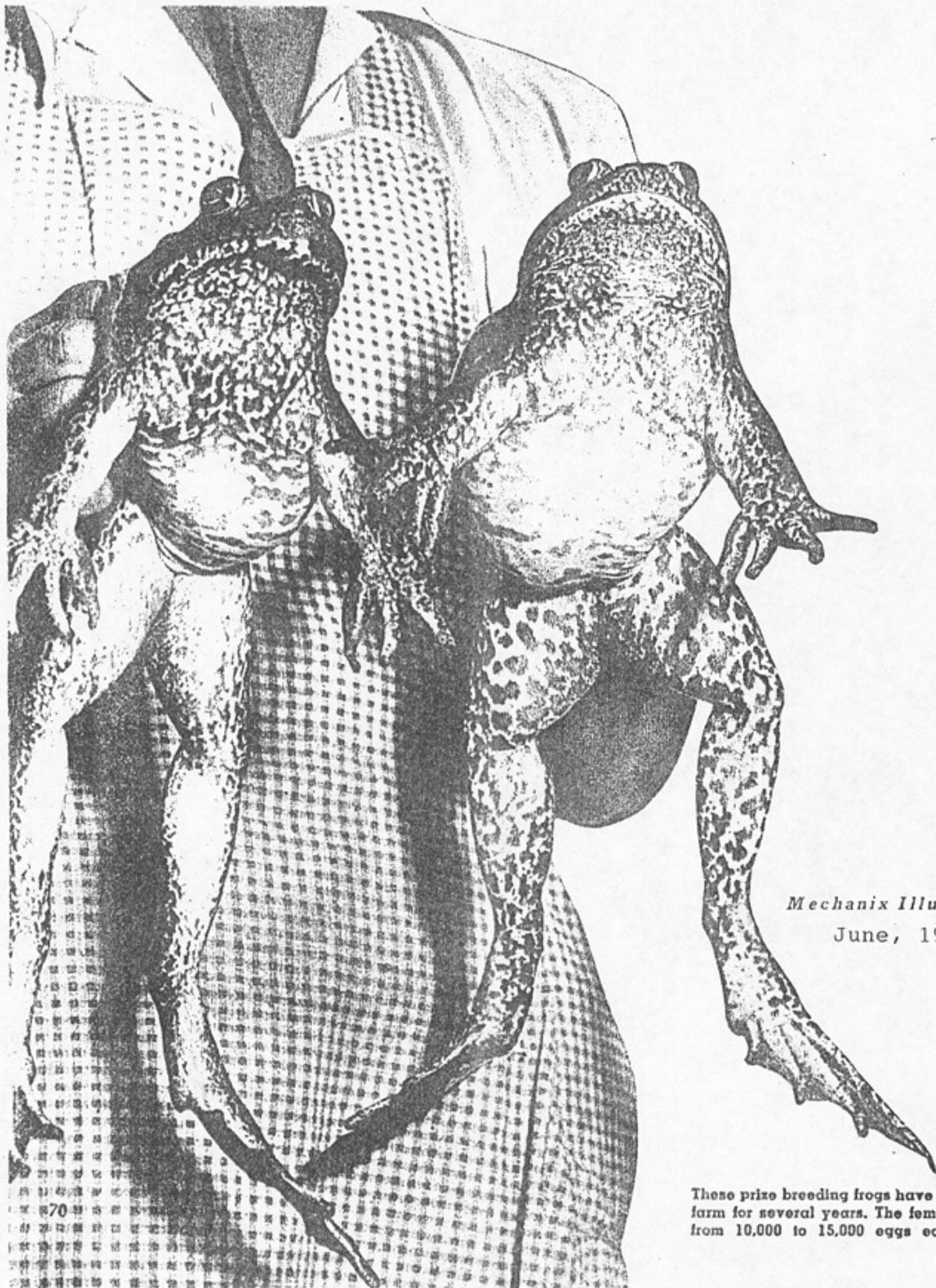


These TOPS can be made from odds and ends. The stem of each is a dowel pointed at the end. Fig. 2 is a silk-thread spool. Fig. 3 is a cotton-thread spool sawed in half and pointed with a knife. Fig. 4 is the lid of a wooden pill box with a hole bored through its center.

HOW TO MAKE A WHISTLE

Select a straight branch of willow, about 5" long and free from sprouts or knots. Cut a ring around the bark through to the wood (Fig. 1, A), cut the other end at an angle (B), and make a small notch in the bark opposite the beginning of this angle cut, as illustrated (C). Now tap the bark carefully all around, between A and B, until you have loosened it and can draw it off whole (Fig. 2). Now cut a long narrow notch in the wood as shown at D. Remove a few shavings between notch D and the end of stick to permit air to pass from the mouth into the notched chamber at D. Finally slip the bark back on, put the slanting end in your mouth, and blow. You will have a fine whistle—maybe. If it does not work well, it is because either the notch in the bark or the one in the wood is too large or too small and so too much or too little air can enter. Only tinkering with these things until you get them right will make you a good whistle maker.





Mechanix Illustrated
June, 1951

These prize breeding frogs have been on the farm for several years. The female will lay from 10,000 to 15,000 eggs each season.

My Business Runs On Frogs' Legs

A million croaking critters in your backyard can prove to be big money instead of a big nuisance.

By Marie Doizaki

"DON'T worry about the cost," the worried young man said. "I want to buy six frogs that sing good and loud."

He had just arrived at my frog farm in Sun Valley, Calif., and he told me a sad story. It seems that he had recently married a girl from Louisiana who was very homesick. So homesick, in fact, that she was threatening to go home to mother. In the course of trying to devise a method to keep her in California, he suddenly recalled that she often said that what she missed most were the frogs croaking at night. And his plan was to keep frogs in his backyard to serenade her at night.

Did it work? Well, I told him if it didn't he could bring the frogs back. And he's never returned.

Speaking of backyard frogs, my husband and I have a million of them and if business keeps jumping we'll have even more. We operate a frog farm on the outskirts of Los Angeles. It was begun several years ago and has proved to be a fine source of income.

Starting a frog-raising farm does not require a great deal of capital. Actually, you

can begin with one pair of breeder frogs which sell for \$12. Our breeding stock was composed of Louisiana Jumbos imported from New Orleans. Even though we began on a small scale, we now have the largest frog farm west of the Mississippi River.

Why raise frogs? Well, they're useful in several ways. They destroy many millions of beetles, plant lice, caterpillars and other insect pests. I watched three of my frogs sitting around a hole from which termites were swarming. Not a single termite escaped. As fast as a termite came out of the hole, one of the frogs would grab it with his long sticky tongue.

Frogs have also served science in the laboratory. Some of our most fundamental discoveries in general psychology, endocrinology and embryology have been made through the observation of frogs.

Frogs must have moisture. Though they live partly on land and partly in water they are equipped to live entirely in neither. They always lay their eggs in water and, of course, the tadpoles must live in water.

Grown frogs start reproducing when

Breeder frogs must be at least three years old. Here, Mrs. Doizaki and a very interested bystander take an oversized one from the net for a customer.

Live crawfish are fed to the frogs every week. The croakers will eat only moving food such as insects, worms, fish, tadpoles and other frogs.



Frogs' legs from all over the world are sold at big-city markets. Left is Jumbo variety imported from Japan and right is domestic American type.



they are about three years old. Each female lays from 10,000 to 15,000 eggs during the spawning season. There is no exact time for this season; it all depends on the weather. Here in southern California where the winters are mild, the frogs usually start spawning around the middle of April and the season lasts until late summer.

They lay their eggs in a jelly-like mass and then enclose this mass in a gelatin envelope. This envelope protects the eggs as they wait to hatch and also keeps them on the surface of the water where the oxygen is more abundant. But it has another very important function—when the wrigglers

are first hatched the gelatin is their only source of food for the first three or four days.

During the spawning season, we take the masses of eggs as they appear on the surface of the large pool and put them in a special pool called the hatchery where they hatch in three to seven days.

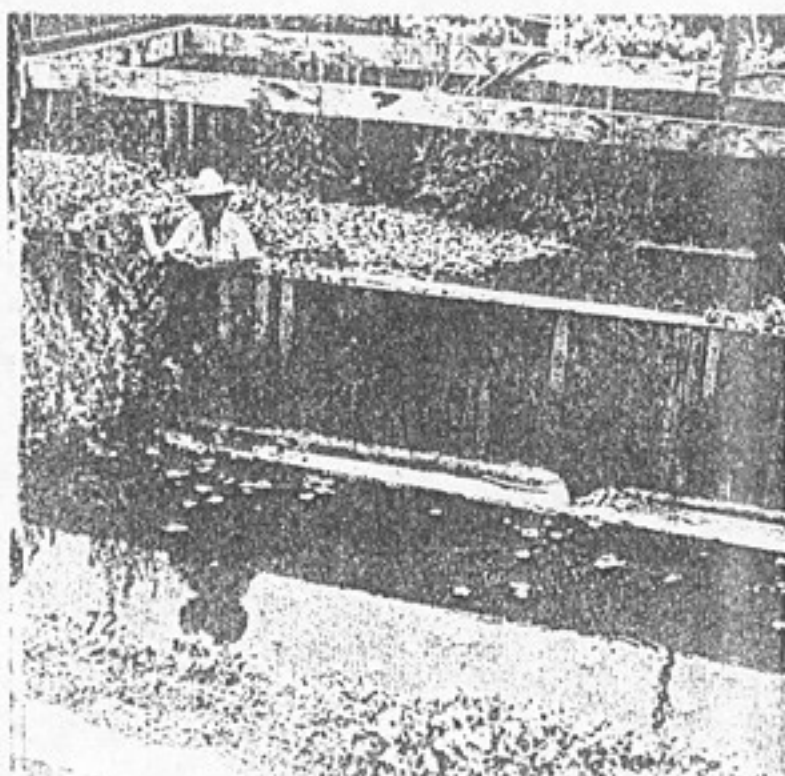
It is quite easy to tell when the wrigglers are ready to hatch. The eggs are a very light grey color when first laid and begin to darken almost immediately. When they are near black in color and the egg has turned completely over inside the gelatin envelope, the tiny wriggler is hatched.

During the time the wrigglers are small they are kept in a special pool equipped for easy draining and refilling with the water changed daily. During this period they are fed ordinary white flour.

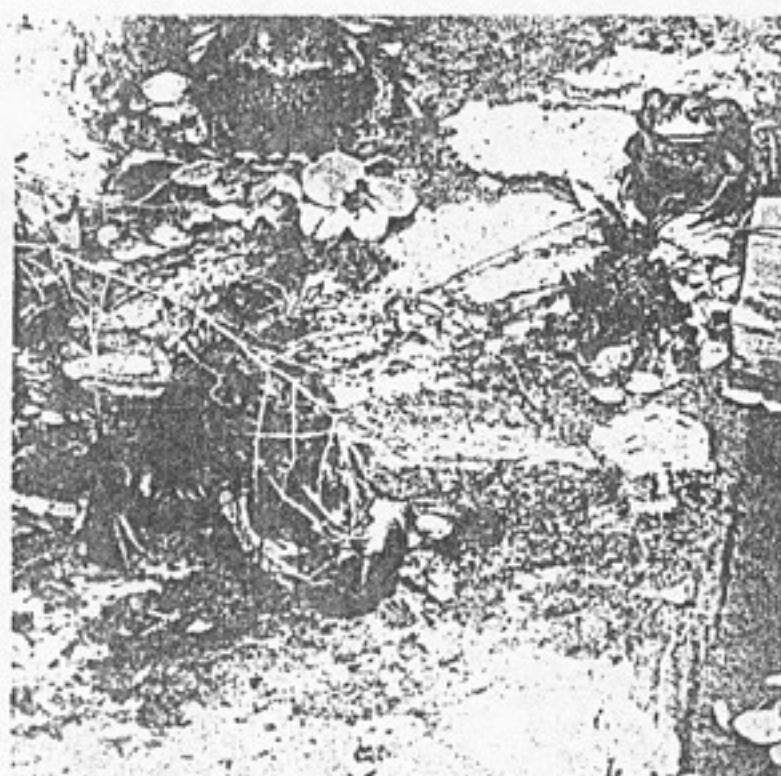
As they become larger, the tadpoles are put in other pools. At this stage, they have large heads and long tails for swimming as well as gills for breathing in the water. As the legs and body form, the gills and tail disappear and soon lungs take the place of the gills. On land, frogs breathe with their lungs and, in the water, through their skin. While in this tadpole stage, they are fed slices of dry bread.

The tadpole makes the complete change from wriggler to frog in three to four months and is large enough for the market within 15 months. Bullfrogs require two years to make the same change, but are much larger.

We have ten different pools on our farm because frogs are cannibalistic and will eat the wrigglers and tadpoles. Breeder frogs will also



Ten pools allow Mrs. Dolzaki to separate the tadpoles from the frogs and the larger breeder frogs from the smaller ones which they devour.



Protected by the natural camouflage of their green skins, these frogs sun themselves on the banks of one of the pools. Note crawfish snack.

eat the smaller frogs. Therefore, it's important to separate them during the various stages. Just a few frogs can completely destroy thousands of tadpoles in a couple of days.

Food is an item requiring a lot of attention and thought. A frog will eat only live food such as worms, insects of all kinds, small fish, tadpoles, other frogs and crawfish. And he won't touch it until it moves. I have seen a large water beetle sitting motionless beside a frog and remain perfectly safe. However, one move and it is gone quicker than the eye can see.

Some people buy frogs to keep as pets—they can be trained to answer a voice command. They will also catch food thrown to them in mid-air like a dog. As you know, frogs are tremendous jumpers and you might say they have leaped their way into literature via Mark Twain's famous *The Celebrated Jumping Frog of Calaveras County*. A leap of 10 or 12 feet here at the farm is very common.

We ship breeder frogs all over the United States and have sent them as far away as Mexico, Canada and Hawaii. The frogs are wrapped in damp gunny sacks to keep them moist and then placed in small wooden crates. As frogs can go for a week or two without food, they can be shipped almost anywhere in the world without damage. Breeder frogs sell

for \$12 a pair plus shipping charges. The tadpoles sell for 15c each or \$60 per thousand. Last year we sold more than 15,000 tadpoles.

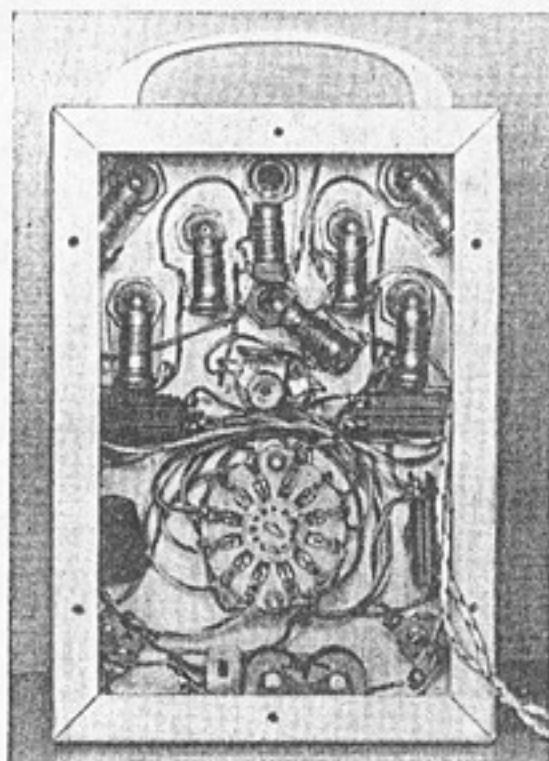
However, our biggest business is selling the frogs for eating purposes. We sell to restaurants and individuals all over the country. In small orders, dressed frogs bring \$1.30 a pound and we sell an average of 20,000 frogs per year. Frogs' legs are very simple to prepare. One of my favorite ways is simply to roll the legs in paprika and flour, then fry in deep butter. I think they have a better flavor than the tenderest of chickens.

The most peculiar request we've ever had came from a young lady who wanted a frog 19 inches or longer and didn't care about the weight, age or anything else. Just as long as it was over 19 inches long.

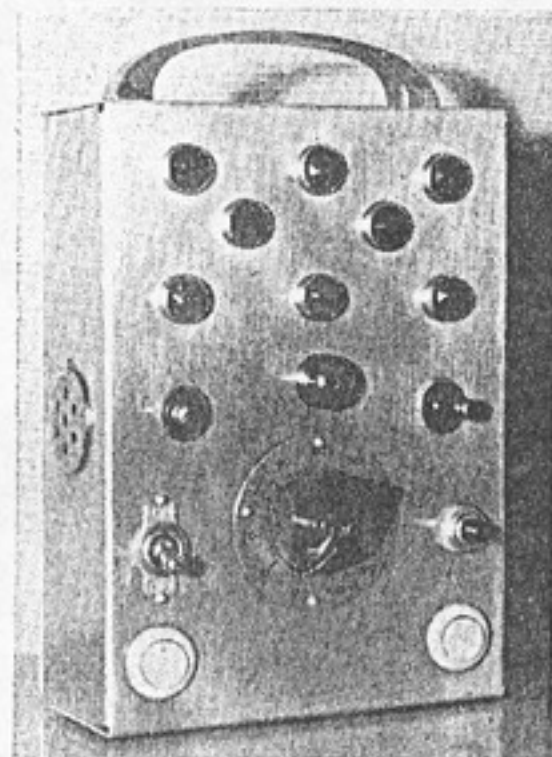
It seems her New York boy friend didn't believe her when she told him that she had once caught a frog of that size in California. He kidded her and said, "If you can produce one that size, I'll eat it alive."

So, I took her out to the pond and found a frog 24 inches in length. Because of his size he cost \$6.

As the girl left the farm she relented just a bit. "I'll give him his choice," she said. "He can eat it or pay for it." •



"Do-Nothing" Box Keeps Child Busy



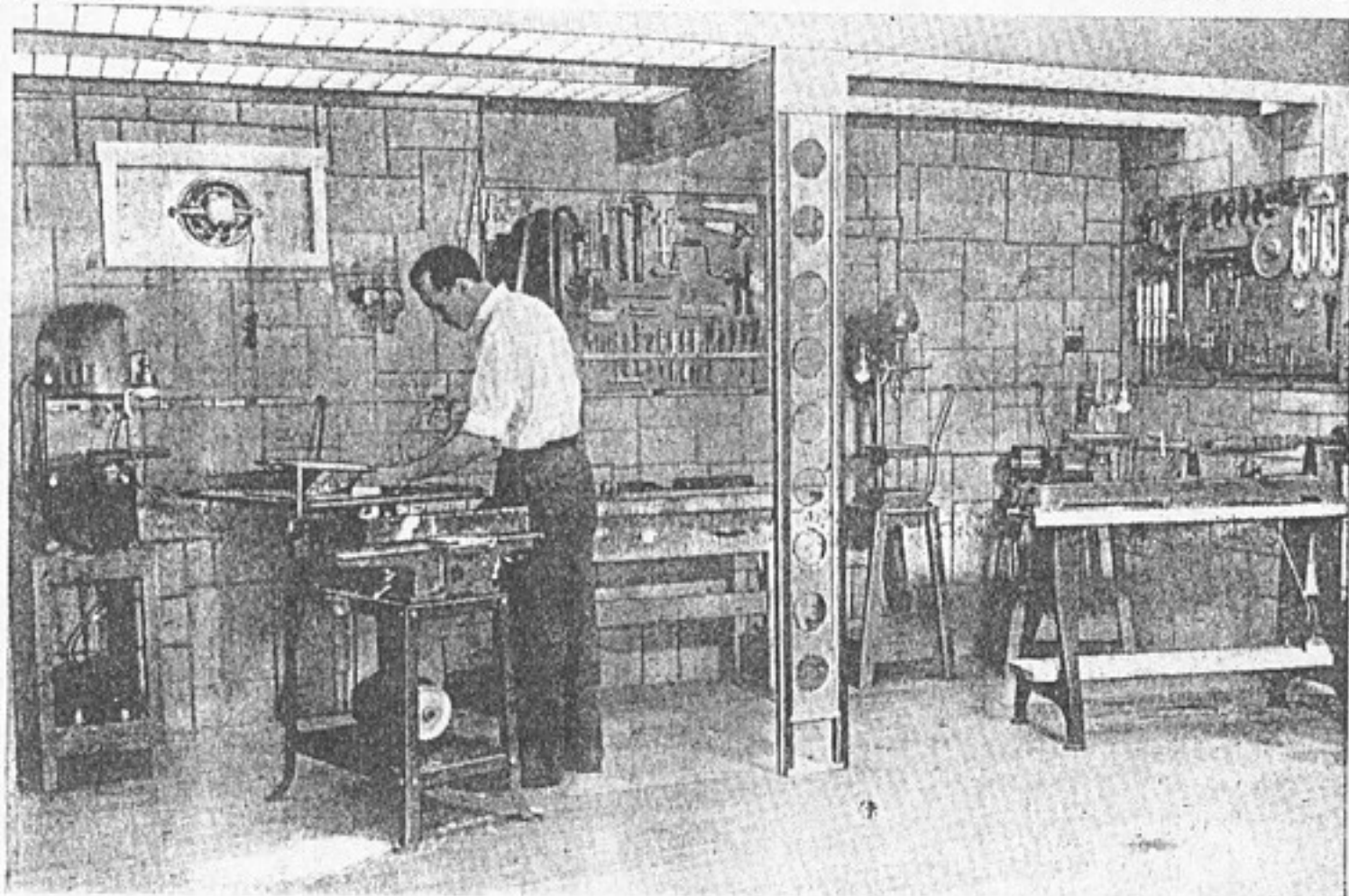
MY UNPATENTED Electronic Dingbat has all kinds of switches and buttons that don't do a single thing except light tiny lights and buzz a buzzer. That's enough. For it keeps the junior-grade Edison in our house away from his usual rainy-day occupation—disassembling my electric clock.

A 10-position rotary switch, toggle switches and push buttons permit him to light up a variety of colored lights, either individually or in patterns. An ordinary

six-volt buzzer supplies sound effects. A 2" by 5" by 7" radio chassis was used for the box, the back being closed in by a sheet of 1/8" aluminum screwed to the chassis.

Power is supplied by a six-volt A battery and the pilot light directly over the rotary switch indicates when the box is on.

Two views of the box give the general idea of what to put in it; your scrap box may give you more ideas.—R. A. Piehl, St. Paul, Minn.



How to Make Money ^{\$} \$ \$ \$ \$ With Your Home Workshop

By James R. Ward

Craftsman Editor, Popular Mechanics Magazine

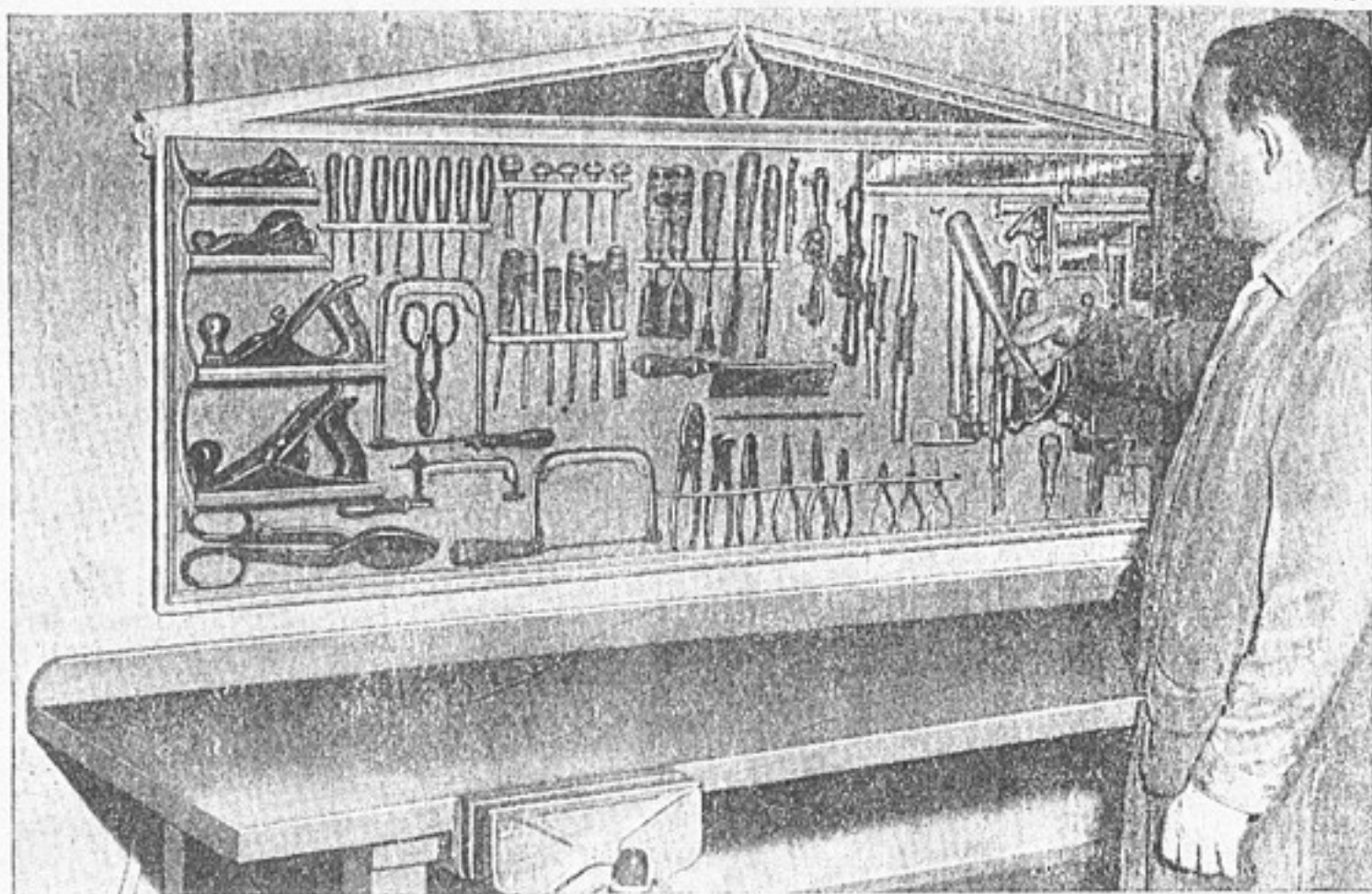
EVERY MAN who has a home workshop, regardless of its size or equipment, has a means of supplementing his income by making and selling projects. It does not matter whether you have a well-planned shop like the one above, a bench and a fair supply of hand tools such as pictured at the top of the opposite page, or a modest shop like the one shown at the bottom of the page, you can make any such shop pay a handsome income from your investment and your spare time. And, if your shop is rather limited, there is no better means of making it the kind of a shop you have dreamed about than to use the present equipment to make some spare-time cash for purchasing additional tools.

If friends admire and desire the things you have made in your shop, others will, too, and will pay for them. That was the beginning for many successful home craftsmen. Your success in making a shop pay a profit will depend more upon how much you really want to make a success of it, how willing you are to profit from the ex-

perience of others and how much effort you are willing to put into the venture than upon your skill and the tools you own.

First, the shop, regardless of its size, must be arranged so there will be no lost motion or unnecessary steps, and the work can be moved from machine to machine as the operations progress. And the projects should be designed so that several duplicate parts can be shaped or machined in one operation. Good lighting is important, too. It costs no more to have a well-illuminated shop than a poorly lighted one—it is just a matter of correctly locating the lights you have.

It is very important to keep accurate cost sheets or records on each project. From these you will know whether or not you are making a profit. Purchase of raw materials also is important, and buying in quantities saves money. Try to design the projects so that they can be cut from boards or plywood sheets with the least possible waste. Also, watch the quality of the wood you use. Many times it is possible to use a

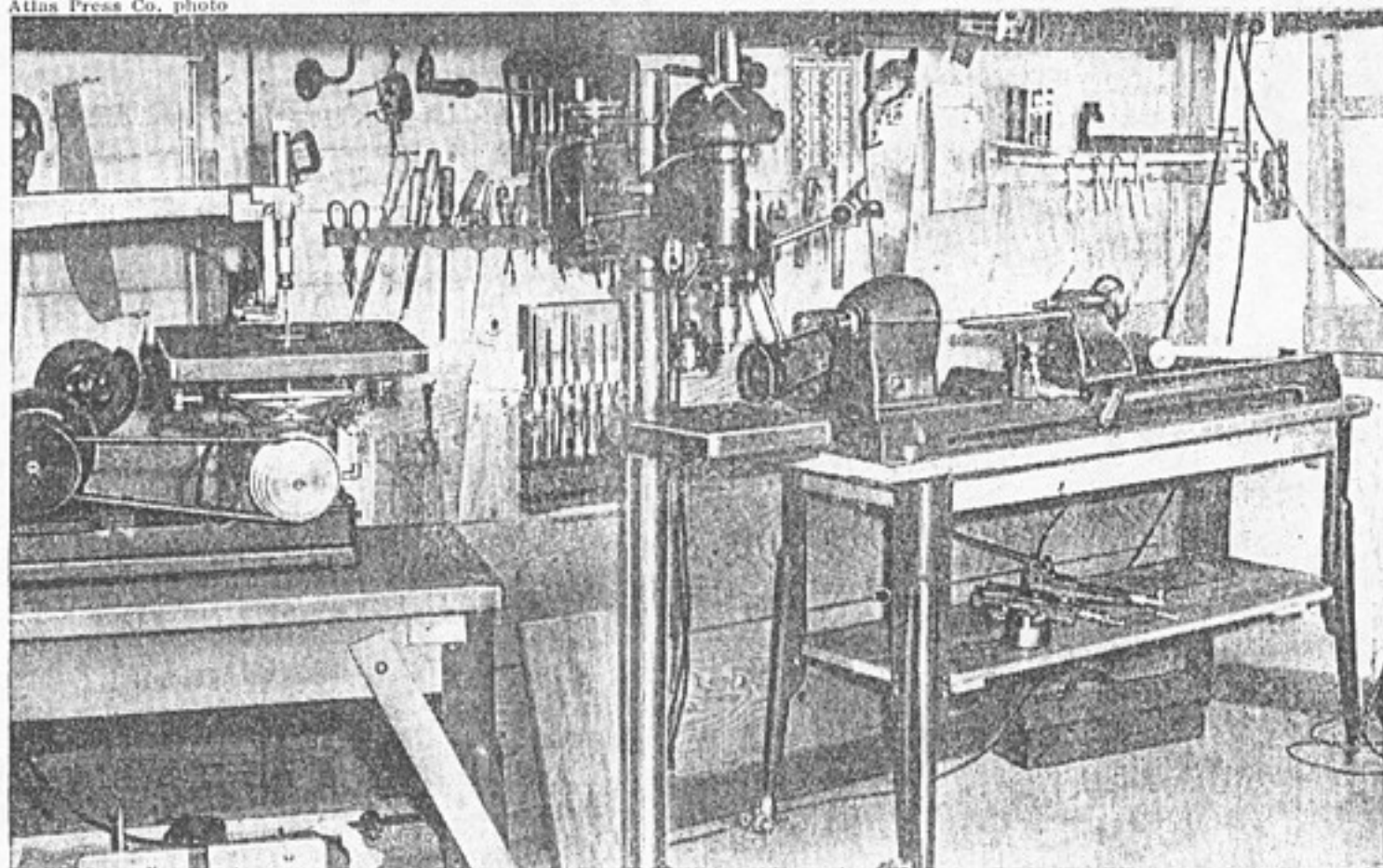


cheaper wood than was at first thought possible. And always keep the finishing of your projects in mind. Bright colors are attention-getting, but don't overdo it. If it doesn't matter materially whether the project is varnished or painted, use paint because you can make it of a cheaper wood if it is painted.

You will find two factors that are very important in choosing projects. The first

is the type of community in which you live and the second is the means by which you expect to dispose of your craftwork. If you live in a rural community and intend to sell from a roadside stand, you should stick to items that will appeal to the tourist trade. However, if you live in a city and intend to sell through gift stores, department stores, etc., you will feature more elaborate and well-finished articles.

Atlas Press Co. photo



the hourly wage your time and skill demand, keeping in mind the local hourly rate for this kind of work. If, for example, it is \$2.00 per hour, go over the bill of materials and decide the time required to set up the machine or machines for each part, how long it will take to cut the parts, sand them and assemble the project. Then, determine the time required to apply the finish and complete the project ready for delivery to the purchaser. Multiply the estimated number of hours by the hourly wage rate and you will have the labor cost. When you first start in business you may find it necessary to reduce the hourly rate in order to keep down the selling cost. Then, as your experience and skill make you more efficient, the hourly rate can be increased. Until you have had some experience in estimating a job you may have some unsatisfactory results. It is possible that you may underestimate and find that it takes much longer to make a project. It is a good idea to keep a careful record of each job and then when the job is finished check the record against the estimate. This will soon show where you erred, so that you will be able to estimate more accurately in the future.

The next item to consider is overhead. Every business has expenses for rent, water, light, power, taxes, sales, delivery, advertising, postage, telephone, etc. No doubt there will be other expenses that should be shown in your overhead account, such as tool replacement and repairs, tool depreciation, etc.

Under rent, for example, you should charge for the space the shop takes in your home. One way of doing this is to figure the total square feet of floor space in your home and basement and then charge rent for the space your shop occupies. Find the percentage of space the shop takes of the total floor space and then write off against the shop this percentage of the cost of operating your home. You can arrive at a given amount for one year and then write off a portion of this amount on each job. Follow a similar procedure for water, taxes, telephone, etc. Expenses for sales, delivery, advertising and postage should be charged entirely against the shop. Light and power, since these likely will be the largest percentage of your home electric bill, should be prorated carefully.

Costs for tool replacement, repairs and additions, as well as tool depreciation, should be spread over each year and then prorated for each project. You can figure about 10 percent of the original tool cost for depreciation each year. Delivery expense, if you use the family car, can be figured at a mileage rate. If some projects



Careful lumber selection saves money and labor

require the use of a truck for delivery, the entire cost of renting the truck should be charged against the particular project. Probably the simplest way of figuring overhead, after you have had some experience, is to charge against each project an hourly rate for the fixed overhead expenses such as rent, taxes, etc. Usually a rate of 50 cents per hour will take care of all overhead.

The fourth item of your accounting system is profit. You are entitled to a profit on every job in addition to the hourly rate. The profit item is to cover the risk you take in bidding on a job and other risks that anyone takes when in a business. Only you can be the judge of what the profit should be. Some home craftsmen use 10 percent of the total cost of the project, while others go as high as 35 to 40 percent.

However, keep in mind when you first set up an accounting system that it may have to be adjusted later. There are several factors that will govern this. Your speed and skill will affect it. Competition and sales resistance may affect it as well as availability of materials. You may find it necessary to reduce your hourly wage rate until such time as you gain skill and speed to warrant a higher rate. Also, varied types of projects may prohibit buying material in quantities, or poor judgment in picking the projects that will sell rapidly may increase your costs. Since your hourly rate and profit are the only two flexible items in your accounting system, these are the items that will have to be adjusted if the selling prices of the projects are too high. However, there are other ways of saving time and production costs which you will learn as you go along. Use of jigs and fixtures will speed your work, and a better knowledge of buying raw materials will help. Also, as your reputation becomes better known, you will be able to increase your sales volume and also your profit.



Many craftsmen prefer an attractive roadside stand as a means of displaying and selling their projects

How to Sell Your Projects

Selling your projects is the most important phase of your business venture. No matter how well you construct them or how novel and useful they are, the projects will not be profitable unless you can dispose of them at the best possible price. Therefore, in planning your homeshop business, serious thinking should be given to the sales angle. There are several methods of selling, which will be governed to some extent by the location of the craftsman and also by his willingness to meet the public. The three most used methods are shown on this and the opposite page.

An attractive roadside stand such as pictured above is preferred by many. However, the success of this type of selling will

Selling by personal contact if production is small



depend on an ideal location as well as availability of help to staff the stand. It should be located on a well-traveled highway or street. Keep in mind that roadside businesses often have failed because traffic could not or would not stop. Therefore, if possible, locate the stand where traffic ordinarily moves at a fairly slow speed. It should be in plain view to approaching motorists for at least 500 ft. ahead so that they will have time to slow down and leave the road without jamming traffic behind them.

Therefore, before selecting a site for a stand, check traffic conditions carefully. Remember, too, your site must have the consent of the landowner as well as the public highway or city street officials.

Once you have a satisfactory location, consider the appeal of the stand. It should be arranged to best display your items to oncoming traffic, and it must be attractive and appealing to the eye. Right here it should be mentioned that careful consideration should be given to which side of the road is used. Traffic will determine this. Traffic leaving a large city or town where there are gift shops and souvenir shops will not be as productive of sales as traffic going into such towns. Also, the type of traffic traveling the highway should be considered. If most of the traffic is local, either side of the road is likely to be all right. However, local traffic entering a town or city is less likely to be interested than traffic leaving town, mainly because most people are in more of a hurry when going into a town than when leaving it. On the other hand, if the highway is a U.S.



Projects displayed in a store window will attract many customers and provide advertising for repeat orders

or state highway, much of the traffic is likely to be made up of motorists on long trips. In such locations, your projects should be of a kind that will appeal to the homeowner, the apartment dweller, etc. If most of the traffic is local, your projects should lean more to the type that would appeal locally.

The second means of selling is by personal contact, such as with friends coming into your home or whom you call on personally. In this type of selling custom work usually is quite successful. Custom work means a project made to the specifications of the purchaser. You will find most cabinetwork, furniture, etc., in this category. If you plan to sell your projects by personal contact, it is a good idea to join as many clubs as possible. The better you are known, the better chance you have. Also, in this type of selling you will find that "word-of-mouth" advertising is one of your best assets. One satisfied customer tells another until before you know it, everyone in your locality seems to know about you.

A third method of selling is to rent a show window in a store, or, if you have enough projects to warrant, rent a small vacant store. When using a store window, you should have a variety of projects well made and finished colorfully. Here again, you should plan your display to appeal to the type of person most likely to see them. If the display is in a large city, you should show items suitable to the person who lives in a city. On the other hand, if the display is in a small town, you can lean more to the garden items, although, of course, items for the home, such as book ends, wastebaskets, wall plaques, etc., should not be overlooked. Keep in mind that the factors governing selection of a roadside site also

should be considered when selecting a show window. It is a good idea to make several checks of pedestrian traffic before making a selection. No doubt, you have noticed that on some streets more people take one side of a street than the other. Also, notice how fast the people move along. Do they have a tendency to window shop in a leisurely manner? If so, that is a good place for your display. In a window display you should have an attractive showcard giving your name and address where the items can be purchased.

The same factors that govern the selection of a roadside stand and a store window also apply if you decide to open a small store. When you sell from a store you will need a clerk who should be a good salesman. Store selling, however, should not be considered unless you have a volume sufficient to keep the store well stocked.

Probably one of the best means of selling through a store outlet is to sell directly to a department store or other store that will handle your production. You cannot get as much for your products by this means, since the storekeeper also must make a profit, but you are relieved of the selling job and can give more time to production. What method of selling to use will depend on your own abilities. If you have a knack for selling and displaying your merchandise to good advantage, you will gain by selling directly to the consumer. However, if you prefer to produce rather than sell, you likely will be ahead by letting a store do the selling job for you.

Other methods of selling are by direct mail or through jobbers. In direct mail selling, you must depend entirely on advertising. The medium that you use and the way you word your ads will determine your success to a great extent.

Shop Arrangement and Illumination

If you have worked out what seem to be satisfactory methods of accounting and selling products produced in your home workshop, the next step is to arrange the shop to get the fastest possible production. Also, you will want to make the shop as comfortable and as cheery as possible, since you will spend considerable time in it.

When you used the shop as a hobby, arrangement and equipment were of minor importance, since time and speed meant little in the way of cost. But in production work time means much in final costs. No matter whether your shop is in a basement, garage, shed or spare room of your home, plan it to save steps and machine operations. In other words, set it up like a production line in a factory. As an example, you might have the circular saw, bandsaw, etc., near the lumber racks. Farther away you place the shaping tools, such as shaper and drill press, and finally the finishing tools, such as lathe and sander. Near these should be the workbench, where assembling is done. This arrangement is only suggestive, as the space and shape of the shop will determine the arrangement to a great extent. The photograph and floor plan on the opposite page are two good examples of a well-planned workshop. If shop space is highly restricted, tool arrangement will be determined by the space available. It is possible to set up a highly productive shop in a fairly small space by arranging the tools to best advantage. As an example, the upright bandsaw, jigsaw, drill press, etc., may be set beside the horizontal tools, such as a lathe and shaper. The tables of the higher tools will be of sufficient height to allow work to be moved across them without the lower tools interfering. When long work is run across the shaper it will, in most cases, slide under the tables of the higher tools.

Usually, you will find that the circular saw and sander are best kept free of other tools, since operations on these tools require freedom of movement. But, regardless of arrangement, time can be saved by keeping all attachments and tools used with the various machines within easy reach. Turning chisels, chucks, sanding disks, etc., should be kept in a rack either on a wall next to the wood-turning lathe, or in holders attached to the lathe stand. Drills and other attachments for the drill press should be kept in a small cabinet close to it, or in a cabinet built right into the drill-press stand. Sanding belts, of course, should be close to the sander. If special cabinets, or cabinets built into the tool stands, are not feasible, it may be pos-

sible for storage in the ceiling directly above each tool.

Hand tools that will be used in your production work should be kept at the workbench. A well-built bench with plenty of drawers under the work surface is always a good investment. Also, consider a good tool board or cabinets on the wall above the bench. The hand tools used most frequently can be kept on the board or in the cabinets within easy reach, using the drawers under the bench for storage of tools used less frequently.

A well-equipped bench for production work should have a bench vise and a woodworker's vise. Locate these at opposite ends. Since vise work may require the handling of long pieces, there should be considerable space at both ends of the bench, or at least, only machines somewhat lower than the bench top should be placed in these locations so that long work gripped in either vise will clear them. Also, there should be plenty of working space in front of the bench, as this usually is the space used in assembly work.

If your capital will permit, some kind of a dust-disposal system is a good investment, especially if the shop is a basement shop in your home. Another thing to consider is sound deadening. When a basement shop is in operation for several hours each day, the noise may become very annoying to the other members of your family. There are good sound-deadening materials that can be applied to the ceiling and walls at a reasonable expense. The shop, of course, should be partitioned from the rest of the basement, using dust-tight construction. In any case, keep the shop clean. Do not allow dust and wood shavings to collect on the floor or under the tools and benches. Such carelessness may result in a fire.

If space is available, you should provide a separate room for painting and other finishing. This room should be vented to the outside air, and an exhaust blower should be used during painting and varnishing operations. If a paint sprayer is used, a special booth should be provided. Extreme precautions must be exercised in all finishing operations to avoid concentration of paint, lacquer and varnish vapors. The floor plan for a rectangular shop given on page 11 shows a good paint room. The plan also shows the location of an air compressor for paint spraying, a drafting table and an exceptionally long workbench. Notice at the upper end how some of the tools are mounted on a bench across the end to conserve space. At the end of this

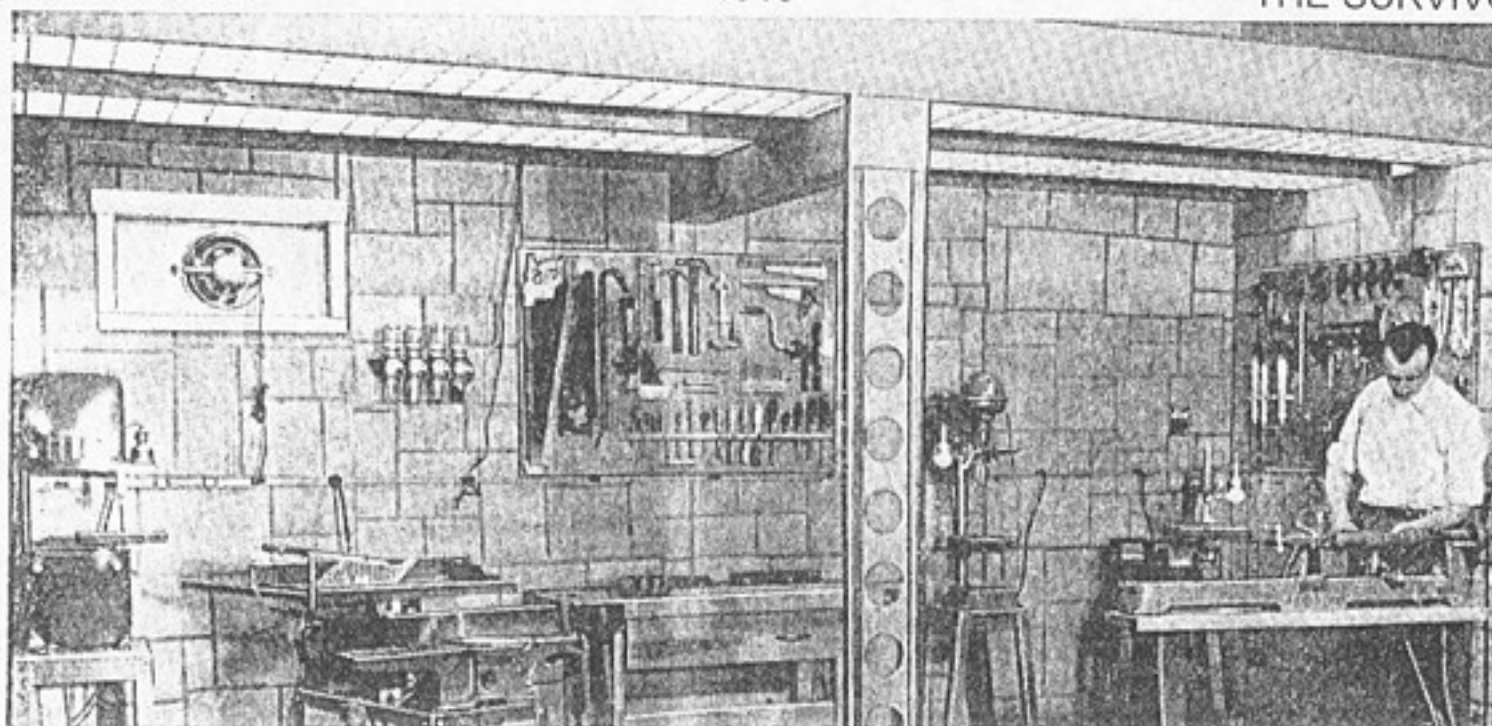
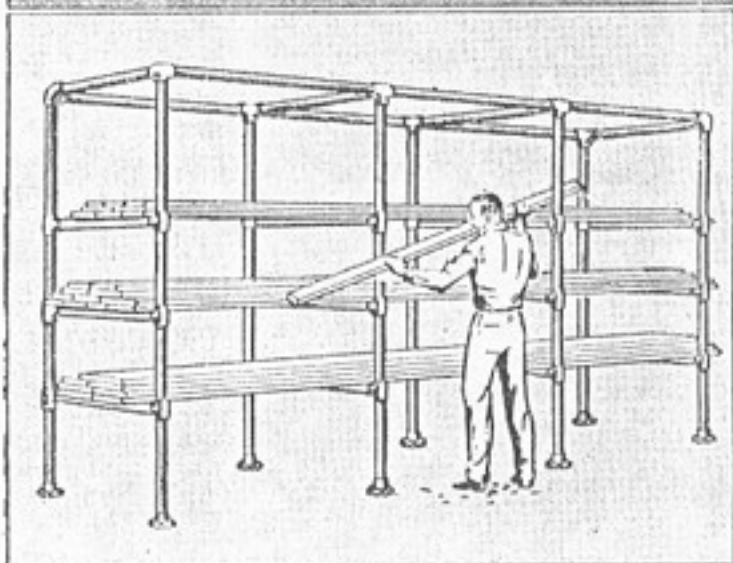
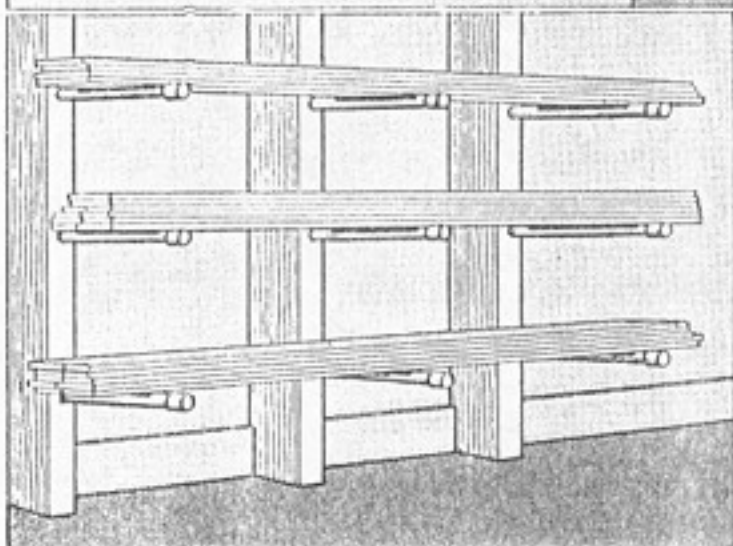
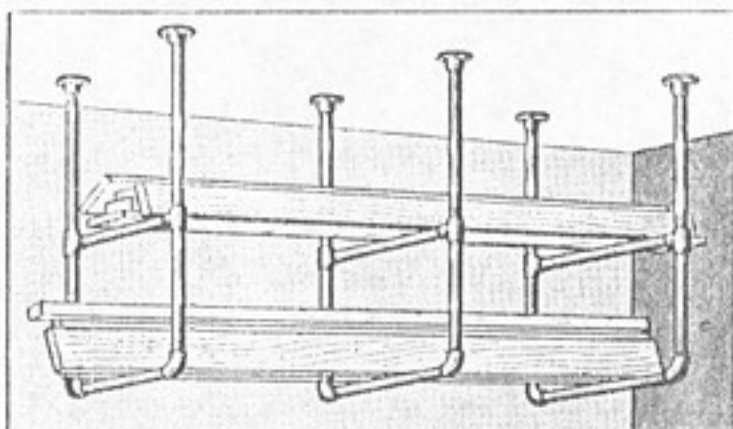


Photo above shows several fluorescent units in ceiling which flood entire shop area with plenty of light



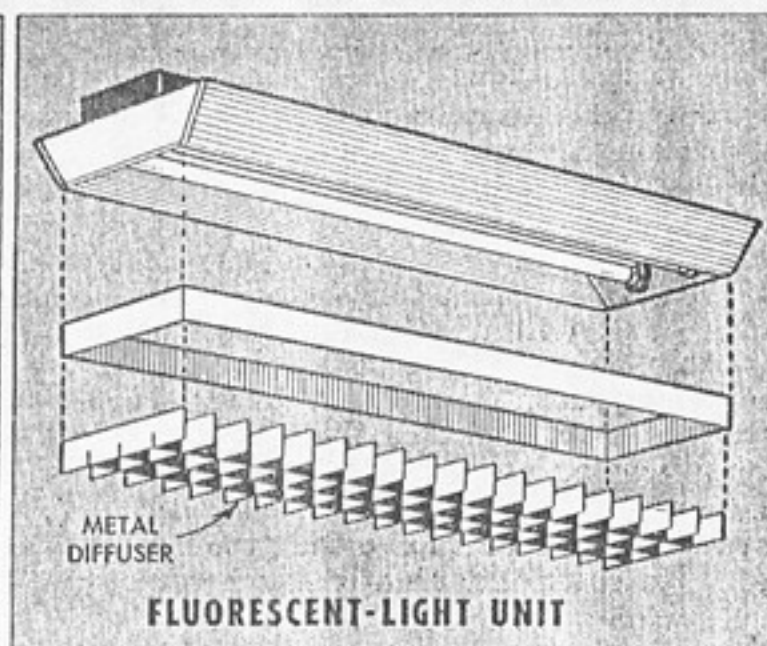
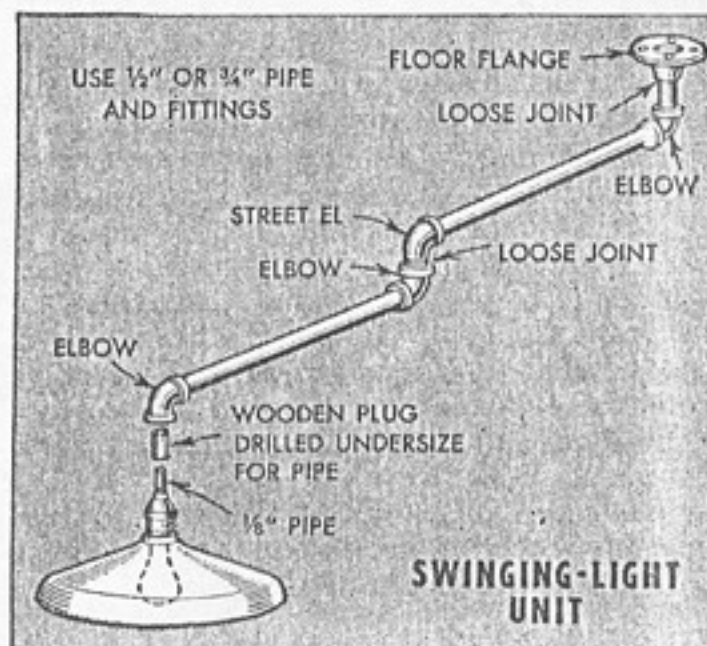
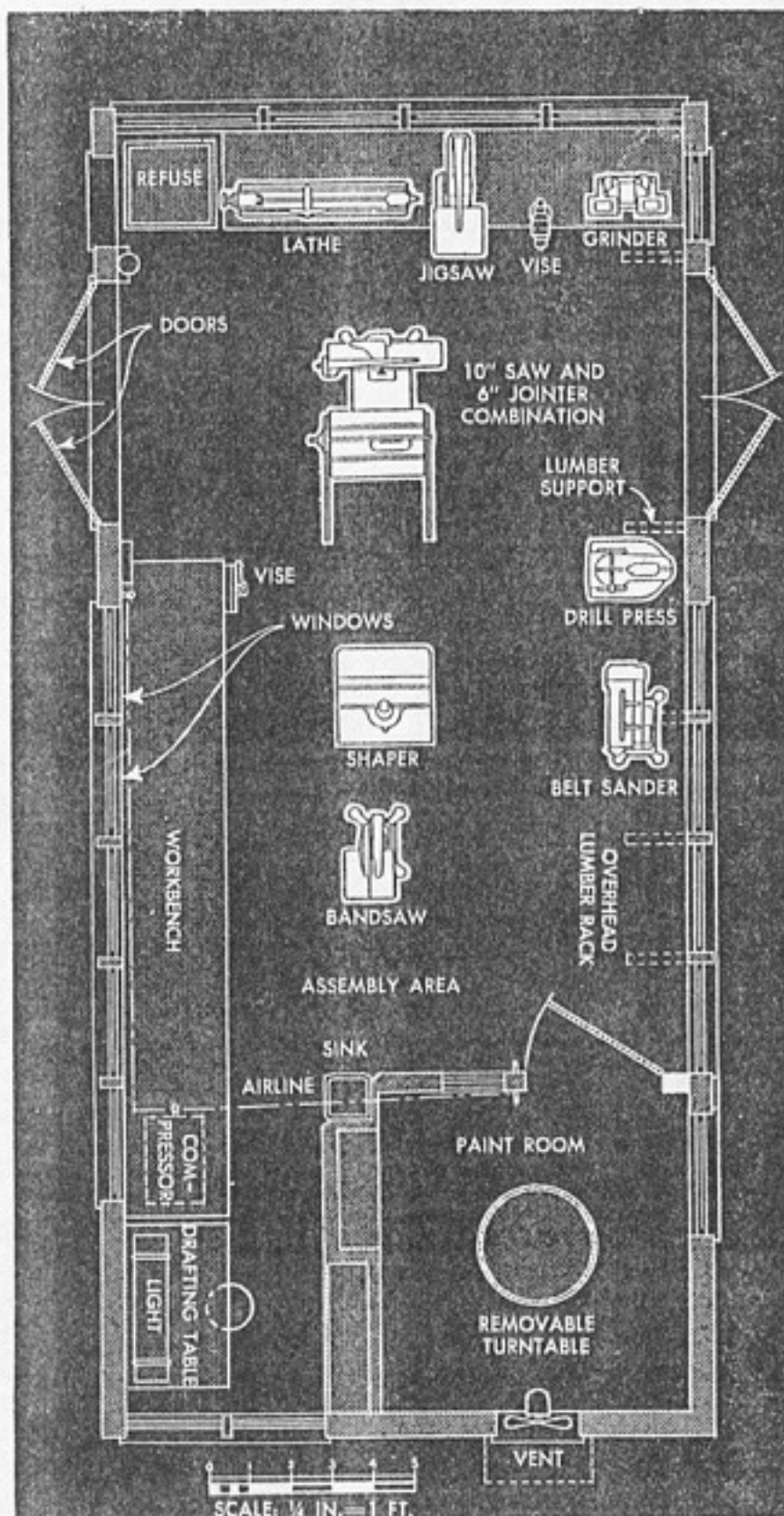
bench is a refuse-storage space for cleaning cloths, etc. When laying out your shop or partitioning space for it, always keep in mind the possibility of expansion in the future. If space is available, lay out the shop larger than your present requirements demand. By doing this now, you will avoid reconstruction if you later decide to expand and possibly employ help.

When making a layout for your shop keep in mind storage facilities for lumber and other construction materials. The three most common methods of storage are shown in the form of racks at the left. These can be of the ceiling, wall or floor type, and they can be made of either wood or pipe, or even angle iron. The neatest racks are made from pipe and fittings. If the ceiling type of rack is used, it is necessary that the rack be attached securely to the joists. The same is true of a wall rack. If the latter is attached to wall studs, be sure that the studs are sufficiently strong to support the weight. Where a wall-type rack is attached to a masonry wall—brick, concrete or concrete block—use heavy lag screws and expansive sleeves. To install these, drill holes in the wall with a star drill to take the expansive sleeves.

The floor-type rack is the safest of the three shown as all the weight is supported directly on the floor. However, this type of rack should also be attached to the ceiling or wall to prevent tipping and to add rigidity. If either of the racks is made of wood, use 2 x 4s and bolt them together securely. It is best not to make the horizontal members of a rack too long as they may sag under the weight of the lumber.

Since natural light is likely to be insufficient in your shop, especially if it is in a basement, you should plan a good lighting

system. Your craftsmanship depends greatly on good illumination. Reference to the floor plan on page 9 will give you a good idea of lamp arrangement for a well-illuminated shop. Notice that regular bulbs are used as well as fluorescent units. Also notice that some of the machines, such as jigsaw, bandsaw, etc. have individual lamps that direct the light onto the work. Fluorescent lamps will give the most light per watt of electrical consumption, but they are not easily shielded to concentrate the illumination in one spot. For this reason, many craftsmen use fluorescent units for over-all lighting of the shop and above the workbench and lathe, and then use bulbs where it is desirable to concentrate the light. However, it is possible to use many fluorescent units in the ceiling as in the photograph on the opposite page and thus illuminate the entire shop brightly. This is the ideal arrangement, of course, but installation is rather expensive. The lower right-hand detail below shows a modern fluorescent unit pulled apart. Notice the metal diffuser, which helps to concentrate the light and direct it downward from the ceiling. These units can be purchased. The lower left-hand detail shows how a swinging fixture can be made from pipe and fittings. A fixture of this type is adjustable to direct light at different locations over a large area. The fixture pivots at the floor flange and at the street elbow. This makes it possible to swing the light in any direction or fold it back to shorten it.



A KNOWLEDGE OF WOOD WILL SAVE YOU MONEY

Knowing what wood to use is very important in production work. A thorough knowledge of woods will not only enable you to make your projects as economically as possible, but it will be an important factor in producing work that will help assure customer satisfaction. No matter how good your workmanship, the wrong wood may make it impossible to produce a finish suitable for the project, or the wood may warp, shrink or pull apart at the joints so that the project is ruined after a few months' use.

Some woods stand up better than others when exposed to the elements. Redwood is one of the best for making trellises, outdoor furniture and similar items. For outdoor projects that will come in contact with damp soil, you had better use cypress. Although cypress has a tendency to splinter, it is the best of the American woods for outdoor and soil exposure. For projects that require steam bending, hickory is one of the best woods, with magnolia a close second choice. Where a tough wood that will withstand various kinds of strains, such as in making mallet heads, is desired, you will find cocobolo the best, with curly maple running a close second. For exposure to water, such as in boatbuilding, mahogany is the most desirable, although cedar also is good for this purpose. In inlaying and built-up-turning work, walnut or mahogany and holly or maple will produce a good contrasty appearance.

The two pines—white and yellow—are probably the most used woods today. White pine, although very soft, will stand up well under most conditions if it is kept well painted. Yellow pine is harder and highly resinous and is used mostly in structural work. It splits easily and does not take a finish well. However, it is one of the least expensive woods and often is used by the home crafters in projects where it can be hidden from view.

It is very discouraging to spend hours machining and sanding a piece of work only to have it split if a nail or screw is driven near one edge. So, keep this in mind when selecting wood for your projects that require nailing. Small pilot holes for the nails or screws will usually take care of this trouble. However, if a lot of nailing is necessary, it may be better to use a wood that does not split easily so as to avoid time wasted in drilling the pilot holes. Beech, oak, mahogany, yellow pine, etc., are the woods that have the greatest tendency to split under nails and screws.

Plywood: Because of its availability and the scarcity and high cost of good cabinet

woods, plywood is being used more and more by home craftsmen. This is available in various thicknesses and faces, and can be obtained for use either indoors or outdoors, the difference being in the bonding agent used. The outdoor type costs slightly more because of the waterproof bonding agent. Plywood can be obtained "good" both sides or "good" one side, meaning that the facing wood is perfect on both sides of the sheet or that one side has a good face and the other may be inferior quality, containing knots, etc. Plywood good on both sides is more expensive and must be used when both sides of the wood are exposed in the project. If only one side of the wood is to be exposed to view, plywood good only on one side is suitable.

Plywood can be finished in the same way as the solid wood with which it is faced. For example, walnut-faced plywood is finished in the same way as solid walnut, and pine-faced plywood is finished the same as solid pine. The same is true of all other plywood faces. Fir-faced plywood is the most common of the plywoods, but the crafter should use it with caution. Fir has a very prominent grain, which makes it impractical for varnish or shellac finishes. Painting is the most suitable finish. Even with paint, care should be exercised to get a good finish. The coarse grain has a tendency to show through.

Under certain conditions, plywood is subject to warping just as any other wood, especially when used in fairly large pieces, such as for cabinet doors. In the thicker sizes, some craftsmen offset the warping tendency to some extent by rabbeting in strips of hardwood, which are glued in place. On the thinner sizes, the plywood is glued-and-screwed to a frame of solid wood. Very neat flush-type doors can be made in this way.

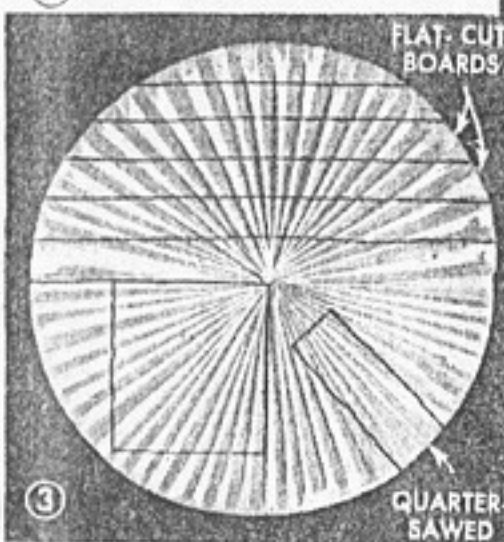
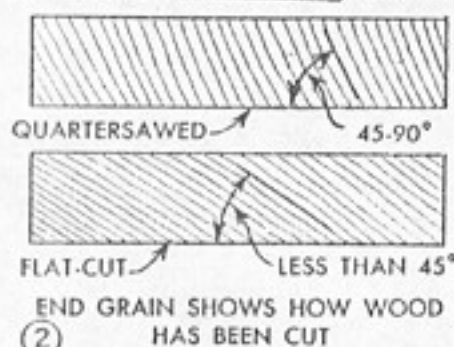
Any homemaker can make beautiful furniture from hardwood-faced plywood if the furniture is designed so that facing strips of solid wood can be glued over the end grain of the plywood. In the case of painted plywood furniture, exposed end grain can be filled with thin glue, sanding down between glue coats to provide a smooth surface for the paint.

Hardwoods: For all practical purposes from the home-crafting angle, woods can be divided into two classes—hardwood and softwood. Oak, maple, mahogany, ash, beech, birch and walnut are the popular examples of the hardwoods. Most hardwoods have open grains that must be filled before applying finishing coats. They also have pleasing grains that lend themselves

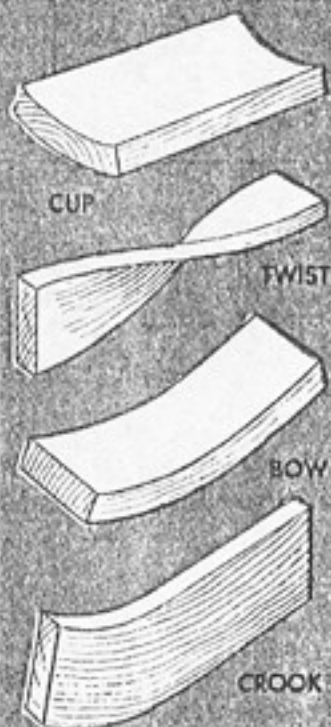
well to varnish or shellac finishes, and their surfaces are fairly hard and do not dent or scuff easily; they are the woods most used in furniture or for turning.

Softwoods: White pine, basswood, cottonwood, elm and many others fall in this classification. They are considerably less dense and much lighter in weight than the hardwoods. Because their surfaces are much softer, they do not lend themselves well to furniture construction, and, in most cases, do not machine as well as the hardwoods. Neither do they take a finish well, nor, because of their softness and easy compression tendencies, will they hold under mortise-and-tenon joints as well.

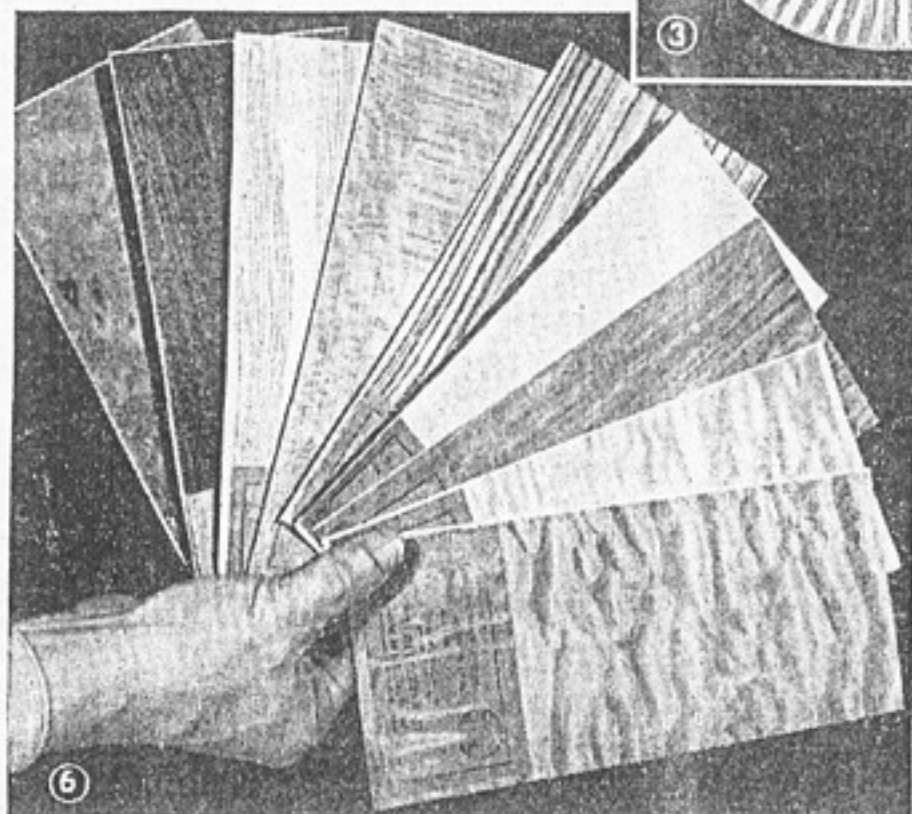
In making projects to sell, the craftsman must be able to answer "yes" to the question "will it stay put?" Otherwise his reputation as a craftsman will be nil and there will be no sale for his products. Therefore, stability of the projects is very important and is directly affected by shrinking and warping of the wood he uses. All woods shrink in seasoning, which causes distortion or warp, some woods being more likely to warp than others as can be seen in Table No. 1 on the following page. The four principal types of warp are indicated in Fig. 4. Warp or distortion can be overcome to some extent by proper use. One of the most common methods of checking a board for warp is shown in



SIGHTING IS A COMMON METHOD OF CHECKING TO DETERMINE AMOUNT OF TWIST OR WIND IN A BOARD. DIAGRAMS BELOW SHOW THE FOUR TYPES OF WARP



TYPES OF WARP ④



PAPER FAN ILLUSTRATES FLAT AND QUARTERSAWED LUMBER AND SHOWS EFFECT OF SHRINKAGE

Table No. 1 WORKING PROPERTIES OF COMMON WOODS

Name of Wood	General Characteristics							Machining					Remarks
	Weight Per Cubic Foot (1)	Hardness	Strength (2)	Stability (3)	Gluing	Nailing (4)	Steam Bending	Planing and Jointing (5)	Turning (6)	Sanding (7)	Shaping	Mortising (8)	
Ash	35	Med.	Med.	Best	Fair	Good	Good	Good 10-25	Fair	Best 2/0	Best	Fair	Tough—Hard to work with hand tools
Basswood	24	Soft	Weak	Good	Best	Best	Poor	Good 20-30	Poor	Poor 4/0	Poor	Fair	Excellent for toys, drafting boards, corestock
Beech	39	Hard	Med.	Poor	Poor	Poor	Good	Fair 10-20	Fair	Good 4/0	Fair	Best	Not durable outside. Hard on tools because of mineral deposits in cells
Birch	40	Hard	Strong	Good	Fair	Poor	Good	Good 15-20	Good	Fair 4/0	Best	Best	Excellent for furniture, turning, dowels, handles
Butternut	25	Soft	Weak	Best	Good	Fair	Poor	Good 10-25	Good	Fair 4/0	Fair	Fair	Furniture—Perfect for walnut imitation
Cherry	36	Med.	Med.	Good	Best	Fair	Poor	Best 10-25	Best	Best 4/0	Best	Best	Furniture, boat trim, novelties
Chestnut	27	Soft	Weak	Best	Best	Good	Fair	Good 15-20	Best	Best 3/0	Good	Good	Stains badly in contact with wet iron. Very dusty in all machining operations
Cottonwood	27	Soft	Weak	Fair	Best	Best	Poor	Poor 5-20	Poor	Poor 4/0	Poor	Fair	Excellent for boxes and other nailing jobs. Wears very well for a soft wood
Cypress	29	Soft	Med.	Good	Fair	Fair	Poor	Good 15-25	Poor	Fair 2/0	Poor	Poor	Tends to splinter. Most durable of American woods for outdoor and soil exposure
Elm (Southern)	34	Med.	Med.	Poor	Fair	Best	Good	Poor 15-20	Poor	Good 2/0	Poor	Good	Very durable under paint. A good furniture wood despite difficulties in machining
Gum (Red)	33	Med.	Med.	Poor	Best	Good	Fair	Fair 10-20	Best	Fair 4/0	Fair	Fair	One of the most used furniture woods for imitations of walnut and mahogany
Hickory	42	Hard	Strong	Good	Good	Poor	Good	Good 10-25	Good	Best 2/0	Fair	Best	Excellent for furniture and long a favorite for steam bending, tool handles, wheels
Magnolia	30	Soft	Weak	Fair	Best	Best	Best	Good 5-15	Fair	Good 4/0	Good	Poor	Excellent for steam bending, although little used as such. Often marketed as poplar
Mahogany	35	Med.	Med.	Best	Best	Good	Poor	Good 5-25	Best	Good 4/0	Best	Best	One of the best furniture woods
Mahogany (Phil.)	33	Med.	Med.	Best	Best	Good	Poor	Good 5-25	Good	Poor 3/0	Fair	Fair	Generally coarser and softer than true mahogany. Furniture, boat planking, trim
(?) Maple (Hard)	41	Hard	Strong	Good	Fair	Poor	Fair	Fair 15-20	Good	Good 4/0	Best	Best	Fine furniture, flooring, turnings, bowling pins. One of the best hardwoods
Maple (Soft)	31	Med.	Med.	Fair	Good	Fair	Fair	Poor 10-15	Fair	Good 4/0	Fair	Poor	Same uses as hard maple but an inferior wood. Difficult to machine smooth
Oak (Red)	39	Hard	Strong	Best	Good	Good	Best	Best 10-25	Good	Best 2/0	Fair	Best	Substitute for white oak in cheaper work
Oak (White)	40	Hard	Strong	Best	Good	Good	Best	Best 10-20	Good	Best 2/0	Good	Best	Interior trim, floors, furniture. One of the most used American woods
Pine (White)	25	Soft	Weak	Good	Best	Best	Poor	Good 10-25	Good	Fair 2/0	Good	Fair	Best all around soft wood. Excellent for paint
Pine (Yellow)	38	Hard	Strong	Fair	Fair	Poor	Poor	Good 10-25	Poor	Fair 2/0	Good	Good	Main uses—House construction, trim, floors
Poplar	29	Soft	Weak	Good	Best	Best	Fair	Good 5-20	Good	Poor 4/0	Poor	Fair	Excellent for carvings, toys, corestock
Redwood	29	Soft	Med.	Best	Best	Good	Poor	Good 10-25	Fair	Poor 2/0	Good	Poor	Excellent for outdoor furniture, window sills, etc.
Sycamore	35	Med.	Med.	Poor	Good	Best	Poor	Poor 5-15	Good	Poor 3/0	Poor	Best	Interior trim, furniture. Difficult to machine, but excellent appearance
Walnut	36	Med.	Strong	Best	Best	Fair	Good	Good 15-20	Best	Best 4/0	Good	Best	Has every good feature for furniture and cabinet work

NOTES

Data in this chart is largely from extensive tests made by U. S. Forest Products Laboratory, with some additions.

1. Pounds per cubic foot, dry. All woods vary in weight, even in the same tree from trunk to top. A variation of 10% over or under average should be allowed.
2. Composite strength value. Woods rated weak are strong enough for all average work.
3. Rated on unrestrained warp. Most woods are quite stable if properly seasoned and cared for.
4. Rated on ability to take nails near end without splitting.
5. All flat grain stock, shallow cut. Rating is average

from runs at 15, 20 and 25-degree cutting angles. Bottom figure is best knife angle for smooth cutting.

6. Rated on smooth cutting and ability to hold detail. Not much difference between best and good.
7. Rated on freedom from fuzz. Bottom figure is coarsest abrasive grit which can be used without scratching.
8. Rated on smoothness of cut. Work speed decreases with hardness of wood and this factor might be of more importance than smoothness in production work.
9. Sugar, white or hard maple. Should be distinguished from silver, red, big-leaf or soft maple, which is an inferior machining wood although often marketed simply as "maple."

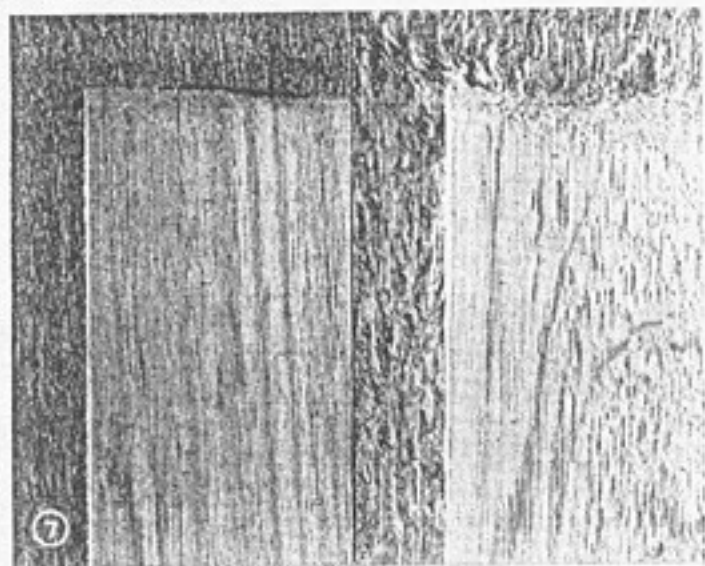
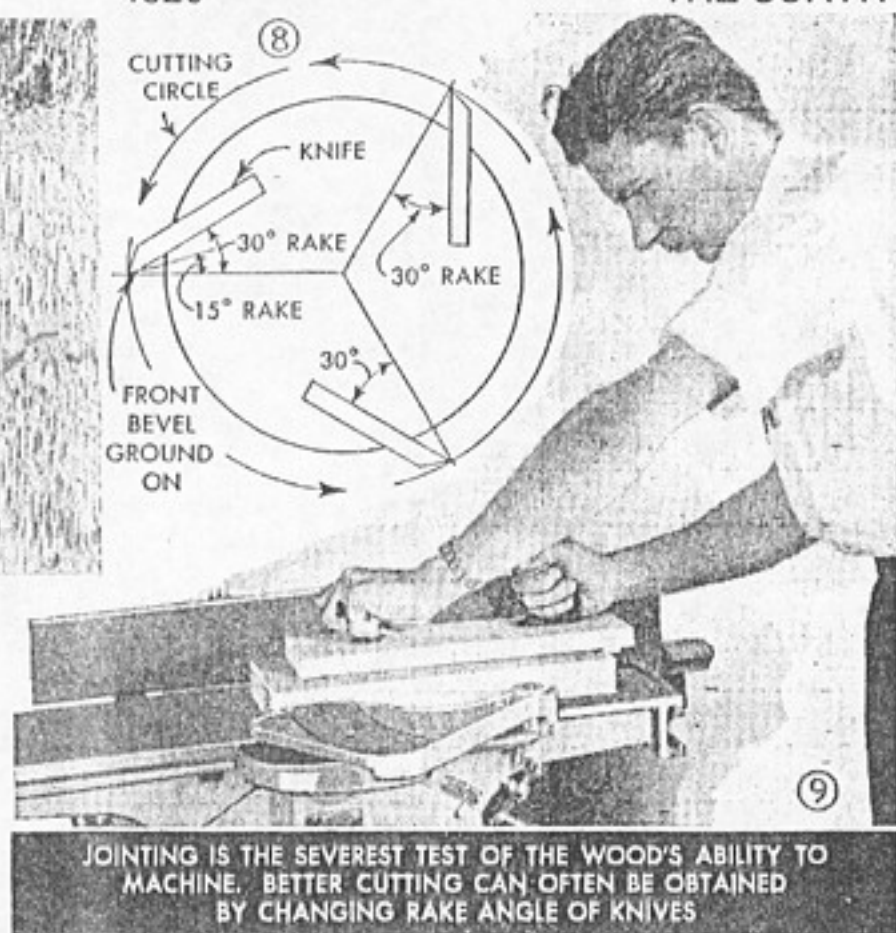


Fig. 1. Strips laid across the board at each end will show up any cupping and also any twist or wind. The cause of warping can be illustrated with a fan made from thin paper about 6 in. wide and 24 in. long as in Fig. 3. Brush marks are drawn across the fan to represent boards sawed from a tree. Shrinkage in wood always will occur along the annual rings, so that if the fan is cut on either side, it will immediately shrink just like a split log would do. What happens to the original straight boards is shown by the fan in Fig. 5. The flat-cut boards always curl away from the heart of the log and the square timber shrinks badly on one side, but the quartersawed is quite stable. It is apparent that quartersawed lumber is preferable. Also, if the board is cupped, it is certain that the rounded side is the heart side. Fig. 2 shows how the end grain indicates the type of sawing. Quartersawed lumber also is known as radial-cut, edge-grain, rift-grain and comb-grain. Flat-cut lumber often is called slash-grain, bastard-grain, plain-sawed and tangential-cut.

When using flat-cut stock, keep the heart side toward the outside surface of the work. Then, if the board should cup, it will show rounded on the face, which is much better than a hollow, and stronger structurally.

Moisture content is very important in wood used for building furniture, which will be stable if the moisture content of the wood is between 6 and 8 percent. Such a moisture content is obtained automatically if the wood is stored for three or four weeks in the same atmosphere at which it will be used. Kiln-dried lumber has a moisture content of about 8 percent, while lumber air-dried outdoors will have a moisture content of about 20 percent. Lumber having a moisture content as high as 20 percent should not be used for furniture until it has seasoned three to four weeks indoors. You can check the moisture content



JOINTING IS THE SEVEREST TEST OF THE WOOD'S ABILITY TO MACHINE. BETTER CUTTING CAN OFTEN BE OBTAINED BY CHANGING RAKE ANGLE OF KNIVES

of lumber by weighing it. First, weigh a small sample exactly, then put it in your kitchen oven. Check the weight at intervals until the wood ceases to lose weight. Determine the weight difference and divide by the original weight to get the percentage of moisture content. The test can be made in a half hour by splitting the sample into thin strips to hasten drying.

Some woods machine better than others. Note in Fig. 7 how walnut takes a smooth jointer cut, while soft maple is very rough. Suitability of various woods for machining is indicated in Table No. 1. Jointing, Fig. 9, is the most important test. Other than the wood itself, the method of machining affects the finished work. This can be observed in jointing, where better work often can be done by changing the rake of the knives. Most small jointers have the knives fixed at about 30 deg. rake. This is excellent for knife efficiency, but the sharp angle tends to tear the grain of many woods. For production work in these woods it is advisable to reduce the rake angle by using shims or grinding a front bevel as shown in Fig. 8. Other useful characteristics of woods are given in the table. The "hardness" column lists woods according to whether they are physically hard or soft. Generally, the botanist's classification of hardwoods (broad-leaved trees) indicates a physically hard wood, but there are several exceptions, including such hardwoods as basswood, poplar, cottonwood and aspen, all of which are quite soft. Exceptions in reverse also will be found. Yellow pine, though botanically classed as softwood,

Table No. 2

WOODS-FINISHING DATA

Notes: NGR = Non-Grain-Raising
(Applies to stain)

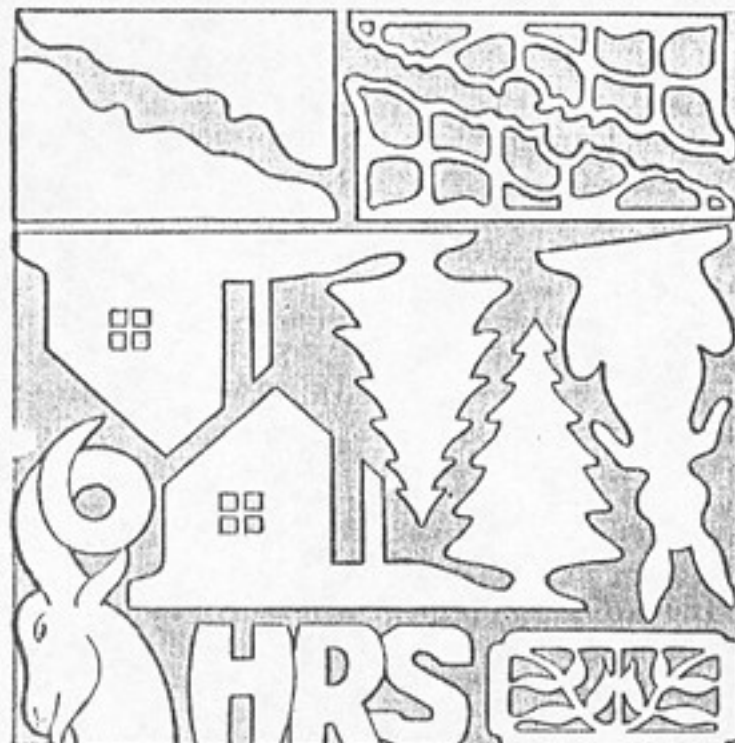
	Natural Color	Usual Grain Figure	Stain		Filler		Bleach	Paint	Natural Finish	Remarks
			Type (1)	Color	Wt. (2)	Color				
Alder (Red)	Pink to Brown	Plain or Figured	Wiping or Water	Red or Brown	None		Yes	Yes	Yes	Principal hardwood of Pacific coast. Like red gum
Amaranth (Purpleheart)	Purple	Mild Stripe or Mottle	None		None or 6	Match Wood	No	No	Yes, Pref.	Usually finished natural to retain purple color
Ash (U.S.A.)	White to Brown	Plain or Fiddleback	Any	Any	15	White or Brown	Yes	Yes, Fill First	Yes	White filler used for frosted finish (3)
Basswood	Cream	Very Mild	NGR	Red or Brown	None		Not Nec.	Yes	No	Fuzzy grain. Usually muddy under oil stain
Birch	Cream	Mild	Any	Walnut or Mahogany	8	Natural or Brown	Yes	Yes, Interior	Yes	Used extensively for walnut and mahogany
Butternut	Heart: Amber Sap: Cream	Like Walnut	Water	Walnut or Oak	14	Medium Brown	Yes	No	Yes	Good for amber walnut without bleaching
Cedar (Aromatic Red)	Heart: Red Sap: Cream	Knotty	None		None		No	No	Yes, Pref.	Red wiping stain can be used to blend sap wood
Cherry	Red to Brown	Good	Water	Red or Brown	6-8	Red to Black	No	No	Yes	Takes excellent finish. Good for brown mahogany
Chestnut	Gray-Brown	Heavy Grain	Oil or Wiping	Red or Brown	15	Red or Brown	No	Yes	Yes	Large pores. Good for novelty finishes (3)
Cypress	Heart: Brown Sap: Cream	Plain or Figured	Water, Oil or Wiping	Red or Brown	None		No	Yes (6)	Yes	Good for sand blast (4) If water stained, see (5)
Ebony	Dark Brown to Black	Plain or Stripe	NGR	Dark Red or Brown	None or 3	Brown or Black	No	No	Yes	Oily. Gaboon ebony is blackest
Elm (Southern)	Brown to Cream	Heavy Grain	Water	Red or Brown	12	Dark Brown	No	Yes	Yes	Cross-grained. Sometimes hard to get even color
Fir (Douglas)	Cream to Red	Plain or Wild	Wiping or Oil	Brown	None		No	Yes (7)	No	Good for sand blast (4) Not pleasing stained
Gum (Red)	Heart: Br. Red Sap: Cream	Plain or Figured	Any	Red or Brown	None or 3	Match Wood	Yes	Yes	Yes	Most used wood for walnut and mahogany imitations
Hickory	White to Cream	Usually Straight	Water	Red or Brown	15	Brown	Yes	No	Yes	Good walnut or mahogany—blond finishes
Holly	Silver White	Mild	Water	Amber	None		Not Nec.	Yes	Yes	One of the whitest woods. Usually finished natural
Magnolia or Poplar	White to Yellow	Mild	Oil or Water	Red or Brown	None		No	Yes	No	Usually painted. Makes fair satinwood imitation
Lacewood (Silky Oak)	Medium Brown	Flake	Water	Oak or Lt. Walnut	12	Dark Brown	Fairly Well	No	Yes	Excellent cabinet wood. Very decorative
Mahogany	Brown to Red-Brown	Stripe	Water	Red or Brown	12	Red to Black	Yes	No	Yes	Best known cabinet wood. Excellent for finish
Mahogany (Philippine)	Brown to Red-Brown	Stripe	Water or Wiping	Red or Brown	18	Red to Black	Yes	No	Yes	NGR stain preferable to minimize grain-raising
Maple	Cream	Varied	Water and Wiping	Maple	None		Yes	No	Yes	Use NGR stain and tone with wiping stain after sealer
Oak (English Brown)	Deep Brown	Plain, Flake or Swirl	NGR	Brown	15	Brown to Black	Yes	No	Yes	One of the best cabinet woods. Also "Pollard Oak"
Oak (Red)	Red-Brown	Plain or Flake	NGR	Green Toner (8)	15	Brown	Yes	Yes	No	Bad grain-raising with water stain, hence NGR stain preferable. Good for novelty finishes (3)
Oak (White)	White to Light Brown	Plain or Flake	NGR	Brown	15	Brown	Yes	Yes	Yes	
Orientalwood	Light Brown	Stripe Crossfire	Water	Amber or Brown	12	Brown	No	No	Yes	Good walnut effects
Pine (White)	White to Cream	Mild	Water (5) or Oil	Brown Only	None		No	Yes	No	Best for painting
Prima Vera	Yellow-White	Stripe Crossfire	Water	Amber	12	Natural or Dark	Yes	No	Yes	Also "White Mahogany". Excellent "bland" color
Redwood	Red	Mild St. Grain	Red only for toning		None		No	Yes	Yes	Excellent exterior wood. Best painted
Rosewood (Brazil)	Red-Brown	Varied	NGR	Red	15	Dark Red or Black	No	No	Yes	Oily. Wash off with lacquer thinner before staining or finishing
Rosewood (East Indies)	Red-Purple	Stripe	NGR	Dark Red	12	Dark Red	No	No	Yes	
Sapeli	Medium Brown	Stripe	Water	Red or Brown	10	Dark Brown	No	No	Yes	Very similar to striped mahogany
Sycamore	White to Pink	Flake	Water	Amber or Brown	None		Seldom	Yes	Yes	Good for natural finish
Walnut	Heart: Brown Sap: Cream	Varied	Water	Walnut	14	Brown to Black	Yes	No	Yes	Obtainable in all figures
Zebrawood	Tan with Brown Strips	Heavy Stripe	Water	Light Oak	12	Natural	No	No	Yes	Very pronounced grain. Good for modern effects

NOTES

- Where water stain is indicated, NGR (non-grain-raising) stain can also be used. "Oil" means penetrating oil stain; "wiping" means wiping oil stain.
- Pounds of filler paste per gallon of thinner.
- All coarse-grain woods are good for novelty finishes, using contrasting filler, usually white.
- Woods with alternate hard and soft streaks can be sand-blasted or burned with torch to cut out soft wood.
- Water stains take better on resinous woods if wood is first sponged with 4 oz. sal soda and 1 oz. washing soda to gallon of water.
- Add 1 pt. benzol per gal. of paint for better penetration (primer only).
- Special sealers available to kill grain.
- For brown tones, first spray weak green stain to kill red color of wood.



Profit often is made right on the drawing board



Design your projects for minimum waste of lumber

Designing Projects and Cutting Stock

Any craftsman going into business for profit should consider carefully the design of his projects and the purchase and cutting of the materials. On these three factors often hinge the amount of profit that can be realized.

Most craftsmen find it best to design projects that differ considerably from anything similar on the market. It is almost impossible for the homeshop man to compete with designs like those that can be purchased. The average manufacturer finds it necessary to stick to projects that are not complicated in cutting and machining. Any complicated work of this kind raises production costs too high. Neither can the manufacturer cater to individual tastes, because this would result in low volume and high costs.

However, you as a home craftsman can do this because most of your projects would be considered hand-produced and not a product of a production line. Because of this you can cater to individual tastes and design projects of intricate shapes which will appeal to your customers. In other words, there is a field for both the home craftsman and the manufacturer. Complicated jigsaw projects are a good example of something that the craftsman can handle.

When laying out a project on your drawing board, work with the idea of cutting the parts from a board with the least possible waste. Waste stock, in most cases, is a complete loss that has to be charged off against the project. Many times by making very slight changes in some parts of a project, you can reduce waste as much as 50 percent

without detracting from the appearance of the completed item. While production time is not as important to you as it is to a manufacturer, you should keep your designs as plain in shape as seems feasible in order not to slow up production too much. Often, by simply eliminating an intricate scroll cut, or by straightening it slightly, you can increase the output noticeably. Also, by avoiding inside scrolls where a starting hole has to be drilled and the jigsaw blade removed to cut it, you may be able to reduce production time as much as 75 percent.

Another thing that consumes production time is joinery. If a butt or half-lapped joint will do, don't use a dowel or mortise-and-tenon joint. A half-lapped joint carefully fitted and screwed and glued is just as strong as any other type, and it can be made in half the time required to make a more complicated one. Drawer construction, too, takes its toll in production time. Dovetail construction of drawers is neat and strong, but there are less time-consuming methods that will result in strong construction and, in most cases, will be just as suitable as the dovetail type.

When planning the design of your projects, keep in mind the possibility of cutting or shaping several duplicate pieces in one operation. If the shape of a piece permits, you can cut five or six duplicate pieces on a circular or band saw just as quickly as you can cut one. The same is true of many sanding operations. If you have several duplicate short pieces to turn in a lathe, use a turning square long enough to produce

two or more of them. This will save setup time. Also, on many intricate turnings, it is possible to grind a turning chisel so that it will form two or three of the shapes in one operation.

You will find that most drilling operations can be performed in duplicate. Many craftsmen use twist drills for wood on a drill press, but for making deep holes, as in drilling duplicate parts, it is better to use auger bits that are made for use in a drill press. Twist drills are likely to burn when used for this purpose.

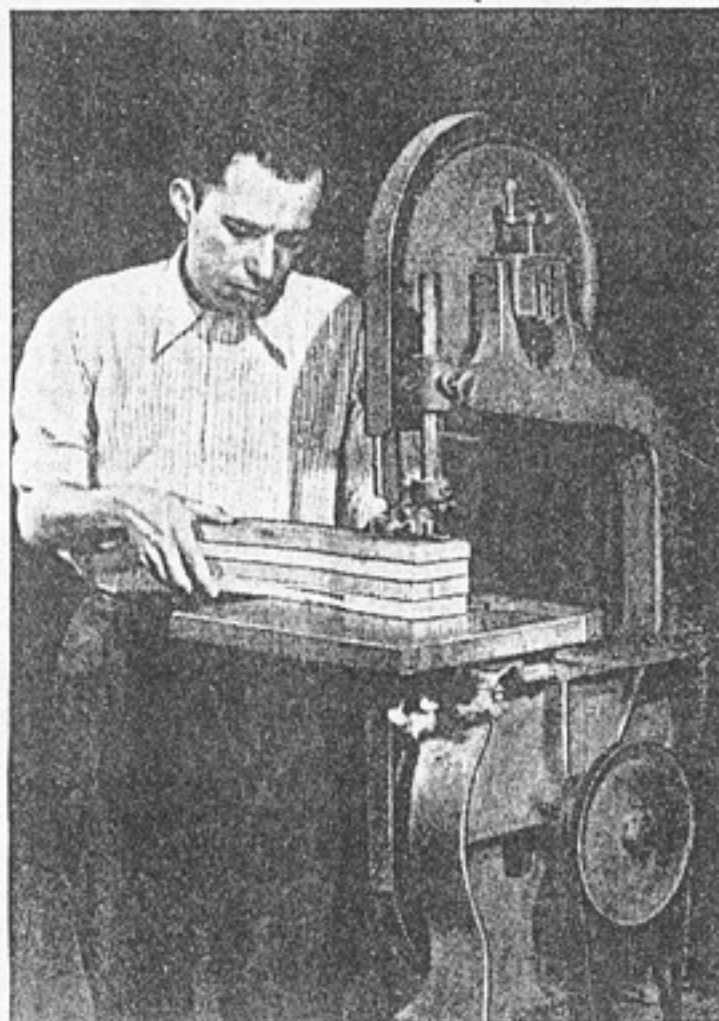
Fairly thin parts that are to be run over a shaper often can be shaped in duplicate by using two separate sets of duplicate cutters, or even three if the length of the shaper spindle permits. The above production factors are only a few that must be kept in mind when designing a project if you are to keep costs at a minimum.

Wood also has a bearing on design. The grain and warping tendency must be taken into consideration. Grain is a very definite factor in a design where one or more of the parts enlarge from a small section. Unless such parts are cut with the grain running the right way, the enlarged section may split off easily. When such designs are used there is a possibility of considerable waste in order to cut the parts correctly with the grain. In most cases, you will find it more profitable to forego designs of this type for others that are less complicated.

The kind of wood — solid or plywood — must be considered, too. Some kinds of projects lend themselves readily to the use of plywood, but this type of wood is entirely unsuitable for others mainly because of exposed edges, and also because of thickness. When plywood is planned for a project, keep in mind that the outdoor type must be used if the project will be exposed to the weather. The indoor type, which is less expensive, is suitable if it is not exposed to weather or other moisture conditions. And, of course, the type of finish proposed will determine the type of wood to be used.

All solid wood is likely to shrink and warp, even plywood when it is used in large sheets. But the extent of shrinkage and warping depends primarily on the method used in drying or seasoning the lumber. Air-dried lumber is less expensive than kiln-dried, but should not be used in the construction of toys, furniture, etc., as the shrinkage and warp of this wood is considerable. This is due to the fact that there is a higher percentage of moisture in all air-dried wood. Kiln-dried wood has a lower moisture content and, therefore, is not so likely to warp or shrink.

No doubt, in many of your projects it will



Duplicate cutting of parts saves production time

be possible to use some of the composition boards on the market. The hard-pressed types are very rigid and take a paint finish well. They also can be worked in on some of your larger projects for paneling, for drawer bottoms and dust stops, such as in furniture construction.

Another angle to consider in buying lumber for your home production shop is used or second-hand lumber. If there are old buildings being wrecked in your locality, you may be able to pick up some good used lumber at a very reasonable price. This type of wood will be well-seasoned, and the possibility of shrinkage and warp will be practically nil. If some of the larger pieces have only a few nail holes, these can be filled and the wood worked into many of your projects. The larger timbers that have been used for beams and supports usually are relatively free of nail holes. These large timbers can be ripped into dimensioned lumber for your shop, or they can be cut into turning squares for some of your lathe work. If the building is very old, you may find some good oak and walnut timbers that will make the best of cabinet woods.

Another source of used material is old furniture, which often can be obtained for practically nothing. Old pianos are a good source of walnut and mahogany, and old tables often produce a good supply of oak and walnut.



Popular Projects that Will Sell

No matter how well your shop is equipped or how well you make the projects, you can't sell them if they do not appeal to the public. Therefore, this is a phase of your business venture that will go a long way in determining your success or failure, and time used in determining the kind of projects to make will be well spent.

Besides the projects suggested on the opposite page, there are the old stand-bys of lawn benches and outdoor furniture, such as pictured above. Also, kitchen recipe files and similar items for the home are popular. When designing projects for sale, try to work up something that is not only practical but also of unusual appearance and utility value. Avoid, if possible, making things that can be purchased in stores. It will be difficult for you to compete with manufacturers who make items by the thousands. It is better to work up designs that can't be purchased elsewhere—designs that a manufacturer would find too costly to turn out on a production basis. You can make such items in a small way and sell them at a profit where cost of manufacture on a large scale would make their production unprofitable.

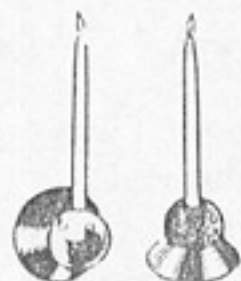
Two other factors also will influence your choice of projects—your ability as a craftsman and the location in which you intend to sell them. If your craft ability is rather limited, it's better to stick to projects that you can make easily without spending a great amount of time, instead of trying to work out a design for which you are not equipped in either skill or tools. There is just as much profit in selling a number of inexpensive items as there is in one or two large items that required many hours to construct. Also, keep in mind that

much of your success depends on word-of-mouth advertising. Therefore the more satisfied customers you have to spread the good news the more prospective customers will come your way.

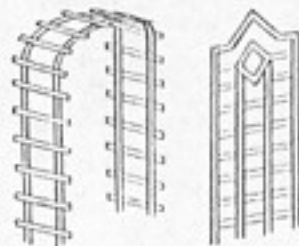
The second factor—the locality—is a very important one. As an example, if you live in a rural community and intend to dispose of your projects through a roadside stand, you should specialize in projects that will appeal to passing motorists. These would include lawn ornaments, simple wall brackets, signs, weather vanes, book ends, wall plaques, etc. In other words, sell articles that can be used in the locality in which a transient customer lives.

On the other hand, if you live in a city or town and intend to sell your work through gift stores or department stores, you will find that projects of higher quality will have more appeal. In this case, you should use hardwoods and hardwood-faced plywoods for your projects. If you plan to depend mainly on friends as outlets, your success will depend on making things that they desire for their homes and gardens. In most cases, this type of business can be done on special-order basis. That is, you will make the projects to the customer's specifications. This can develop into a very good business and will be the most successful method if you can make it work. However, it is the most difficult type of business to get started.

Although only wooden projects have been suggested so far, don't overlook the possibility of metal and leather work. Many people prefer this type of article, and most projects in this group can be handled with a relatively small outlay in tools. This is especially true of leathercraft.



Unusual projects like the novel candlesticks at the left offer wonderful possibilities. The ball in which the candle is inserted pivots so that the holder can be used on a table or hung on a wall



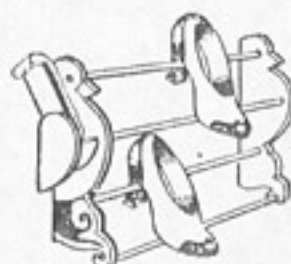
Trellises and arches are old favorites and always sell readily. They will move well if you work out designs that are unusual in shape as well as appearance. Avoid designs that are hard to assemble



Book ends are another item that will move easily. Work out design motifs peculiar to the prospective customer. Besides modern designs as pictured, make some in keeping with hobbies, vocations



A sure seller is lamp bases in contrasting woods, such as maple and walnut. Glued-up turnings for this purpose are not difficult to make and the blocks for making them can be had from cabinet shops



Clothes-closet accessories such as the shoe rack at the left are always popular. Work them up singly and in sets. Here, again, unusual designs count. Make them for both children and adults



There's nothing that appeals to the homeowner quite so much as a house number patterned after his pet. The Scottie lawn number is a good example. A design identifying a hobby is good



A well-designed whatnot shelf will be difficult for a lady customer to refuse. These can be turned out at a good profit on a jigsaw. Neat designs will move at a good profit almost anywhere



The old stand-by, the birdhouse, is something not to overlook. Simple wren and bluebird houses are always in demand. But you will need some more elaborate ones such as the martin houses

Kitchen accessories* such as knife holders are popular. The feminine members of your family can suggest good designs. Motifs of women's hobbies will help boost your sales of these desired items



Plant holders, both outdoor and indoor, will appeal to your lady customers. Keep the designs plain but colorful so that you can sell at a price the women will pay and recommend to friends



Neat and unusual table accessories are always popular. The fruit scoop at the right is a good example. Silent butlers and turned fruit bowls are other items that are easy to sell to women



Most parents can't resist an attractive seat or rocker for the infant member of the family. A few designs tried out on the mothers of your acquaintance will help you get started on good sellers



Knockdown lawn and picnic furniture that can be put together in a jiffy without nails or screws will find a ready sale to town and city people. You should use outdoor plywood for these jobs



Almost any homeowner will be receptive to a weather vane for his garage. Make them of metal, preferably brass, and don't overlook the hobby or vocation motif. Good workmanship counts



Every dog owner will be interested in a well-designed dog house. Work up some unusual designs and make them for both small and large dogs. A miniature of the owner's home will sell



Kitchen dispensers for use with powdered soap and soap chips, sugar, salt and other kitchen supplies will be popular. Be sure the pouring spout will permit the ingredients to pass easily



Fence around yard behind Freddie Fixit's shop displays partial list of jobs that Bazarian and his helpers will tackle. The appliance repair corner is well stocked with tools and parts—as well as appliances that are waiting to be put in good working order.

Make Good Money With a Fixit Shop

By JAMES JOSEPH

AS A journeyman locksmith for 10 years, Los Angeles' Fred Bazarian had often played Galahad. He'd freed moppets from locked bathrooms. He'd rescued scantily-clad damsels, inadvertently latched-out during a search for the morning paper. And more than once pistol-packing city detectives had stood by while he fashioned an apartment-door key. Tumblers—any size, any make—never baffled Fred Bazarian's nimble fingers. But something else did.

That "something" usually happened just as he was putting away his tools.

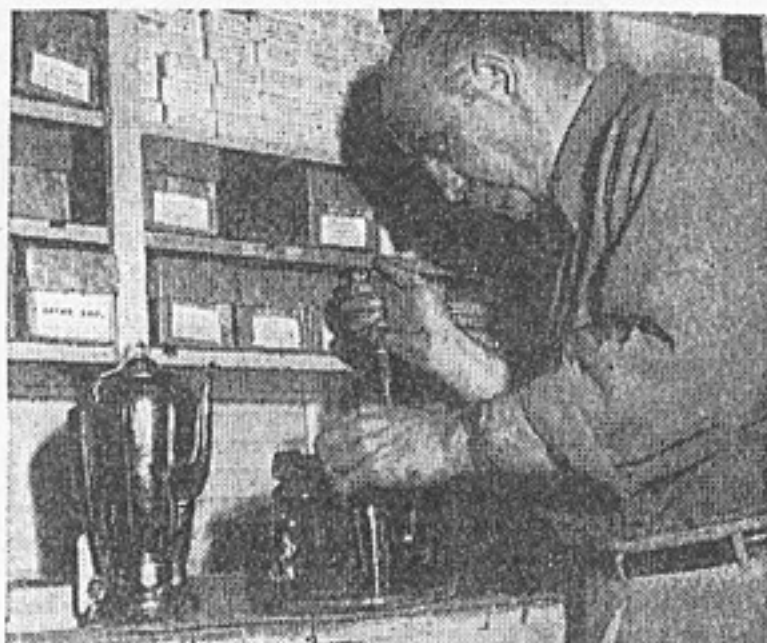
"Say," a lock customer would venture, "could you fix my electric toaster?"

"Better call an electrician," Bazarian would advise.

Through the years fixit requests grew more persistent. Will you rehang a front door? Can you spare a minute to put up these curtain rods? Any chance of replacing a busted window in the basement? Closet needs a couple more shelves. How about tackling the job when you've finished that lock? There was no end to it.

Patently, Bazarian directed customers to carpenters, glaziers, appliance repairmen, and to furniture refinishers. Then one day in 1948 he got to thinking that perhaps he should open an all-around fixit shop. But weren't there already a dozen fixit men in town? He investigated, and what he saw (typical of the situation across the nation) almost convinced him that fixiting wasn't the business for him.

He found fixit men all right. A score of them were listed in the phone book. But when he visited their shops he found them in back alleys, over garages, set-up in the backrooms of dilapi-



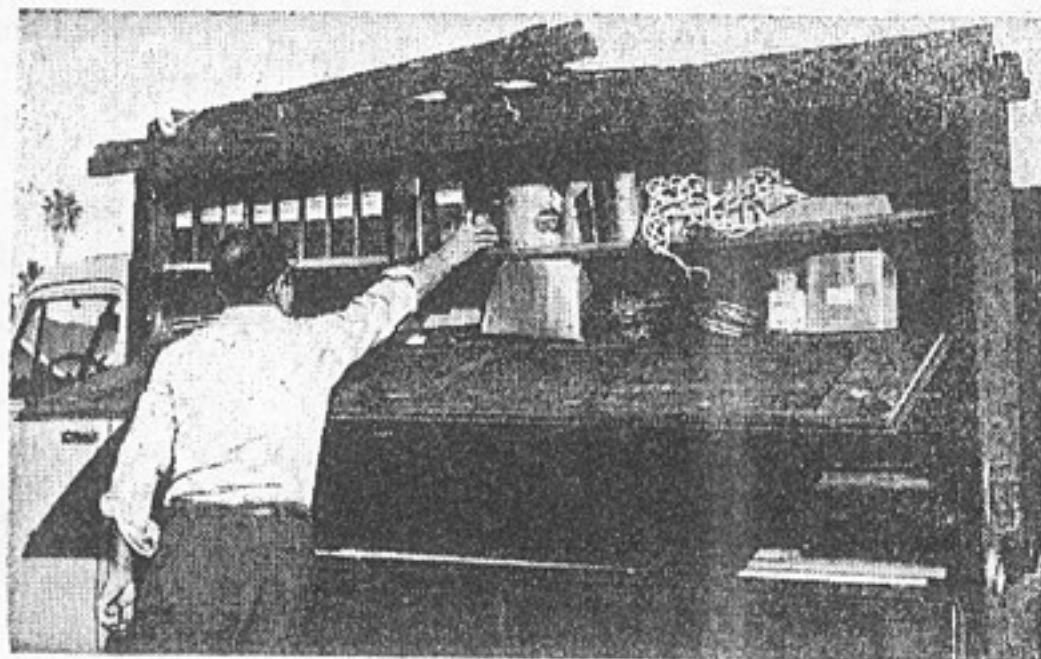
dated houses, crammed behind dingy store fronts. Fixit men everywhere related the same tale of woe: "No money in the business!" "People want everything for nothing."

Thousands of you readers, like Bazarian, possess talented hands and nimble minds. Fixiting for profit is right up your alley. But perhaps you've also been discouraged by the sad straits so many fixit shops seem to be in.

Then consider Fred Bazarian who is "Freddie Fixit" to hundreds of Los Angelenos. His four-room office and shop, spankingly in order and businesslike, daily dispatches two bright, new, fully-equipped service trucks. Orders flood his desk. He'll heal that end-table's cigarette wound. He'll hang those pictures, repair your electric iron, rehang your garage doors, and patch that shattered garden gate. In just four years, "Freddie Fixit" has become fixit-man extraordinary, and sole proprietor of a business grossing a tidy five-figured sum each year.

Why is "Freddie Fixit" successful where others have failed? Simply because early in his career he diagnosed the fixit man's shortcomings: Too many were mere tinkerers, not craftsmen.

True, they could repair a fence, but if a householder asked for a touch of redesign, they were stumped. They could mend a banister but fell flat on their faces when a physician called, asking about design and installation of exercise platforms for orthopedic patients. Special problems were outside their grasp. The trouble, Bazarian figured, lay in their failure to keep pace with an age demanding specialists. Clearly the need was



Specially built body on 1952 Chevrolet truck carries tools and supplies to homes that need on-the-spot fixiting. Touch-up section shown here has waxes, paints, adhesives, window screening, clotheslines. Note ladders atop truck.

for specialists, not handymen. And Bazarian decided to specialize—in fixit.

His course was set, in fact, by the very first customer who phoned. "Send me a craftsman, not a handyman," she demanded.

There were two requisites for success in the fixit game. One was a high order of skill in a number of related crafts, like carpentry, furniture repair-refinishing and electrical appliance maintenance. The other was promotional know-how—the ability to sell your skills to the householder. Without both, Bazarian knew he'd be working for wages—and not much else—as were the fixit men he'd interviewed.

Starting with a few thousand dollars he'd accumulated from locksmithing, Bazarian rented a real estate agent's little two-room bungalow on a busy Los Angeles street. He made a deal with the landlord. Rent would be a percentage of his

gross. If he made no money, he'd pay only minimum rent. If he succeeded, he'd pay increasingly more. This was big-business method in miniature. Today his rent averages about \$100 a month.

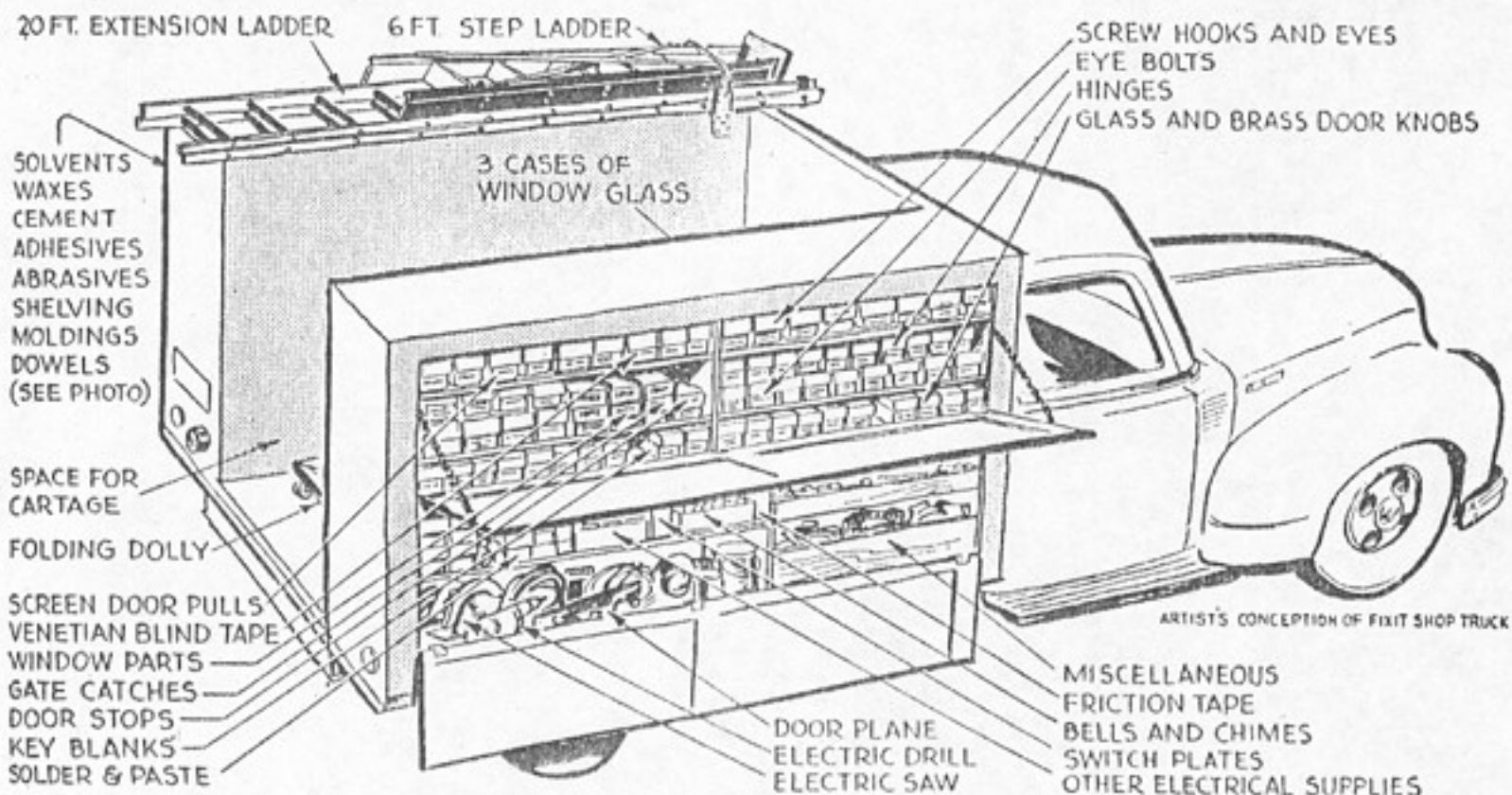
He enlarged the place, adding two rooms which became his shop. For \$1,400 he latched onto a '39 Plymouth station wagon, and converted it to a traveling tool chest. He bought an 8-inch circular saw and stocked \$50 worth of wood-working and carpentry tools to add to his locksmith kit. The real estate agent, who retained a desk in his office, agreed to answer his telephone. Commercial answering services, decided Bazarian, weren't

practical for fixit men. Trouble was they couldn't answer customers' questions. His physical layout, extremely modest, included tools, truck, and room additions and represented an investment under \$2,000.

Then, cognizant that walk-in business would comprise but a small percentage of his total gross, he decided to splurge.

"I gave myself one year to get established," relates Bazarian. "And I bet everything on big-business advertising methods. I'd either sink or swim depending on how fast I got my message to prospects."

He took ads in the yellow section of the phone book under a half dozen different categories, including: "Fixit," "Electrical Appliance (household) Repairs," "Glass—Auto, Plate and Window," and "Household Repairs."



tory (which lists residents by street sequence), and mailed 10,000 advertising postcards a month. The mailings cost 4¢ apiece, an investment of \$400 monthly. Bazarian didn't eat too well that first hectic year, and every dime he made was plowed back into the business.

Bazarian tried to analyze the typical fixit customer. He wouldn't be a poor man, probably not even a guy in the lower-middle bracket. Freddie Fixit aimed at the high middle-income groups and the moderately wealthy. An average customer likely made over \$5,000 a year, owned his own home (somewhere in the \$16,500 class), had a couple of kids and a dog (children and dogs are always making work for the fixit man), and possessed an armada of electrical appliances.

Bazarian figured that very few customers would be young-marrieds or GI home owners. Ex-GIs liked to tinker in their own garage workshops come Sunday, a penchant which boded no good for the fixiter. But when a man reached his mid-30's, and was fairly prosperous, he delegated household repairs to the fixit man.

Bazarian's earlier estimates have proved correct. Most of his business comes from the over-30, high-middle-and-above income families. The average fixit bill exceeds \$10 and most families need a repairman about three times yearly.

Fixit craftsmen must narrowly channel their work. Bazarian, for example, does no plumbing. "No money in small plumbing repairs, and to do big jobs you need a license," he says. He'll repair a broken door, but won't construct a new one. Electrical work ends with switch and outlet repair. He undertakes no electrical alterations or rewiring, which require licenses. Nor does he tackle radio circuit tracing, motor rewinding, or TV repair. Freddie Fixit will replace a downspout but won't touch the rain gutter.

Yet within these narrow limits, Bazarian has a wide range of highly skilled crafts. In almost every case, his fees are flat-rated, that is, based on a set price per job. To shave off a door-bottom after carpeting has been laid, he charges a flat \$2.50 per door, whether the job requires five minutes or 30. He'll repaint your bird cage for \$3. Only occasionally does he work by the hour (hanging pictures, installing curtain rods). The reason is basic: his business' startling gross is predicated on getting onto a job and off-again in the shortest time possible, yet turning out flawless workmanship. He charges \$5 minimum for house calls.

"Our rates aren't cheap," admits Bazarian, "but neither is our workmanship." Then he adds, "We're not working for wages, like most fixit men. We're charging for our specialized skills.



Chair, on revolving platform and inside paint booth, gets spray gun touch-up by Fred Bazarian.

We send all-purpose craftsmen into the home. One of our men may hang two doors, repair a half dozen locks, install a new screen and mend the kid's playpen. The total bill may run to \$15. Yet if the householder called in each of the trades represented, she'd pay at least \$50. Today's fixit man must be a highly skilled, exceptionally versatile craftsman."

On a typical day last month I went the daily rounds with one of Freddie Fixit's craftsmen. At 8 am we loaded one of his two $\frac{3}{4}$ -ton, '52 Chevrolet trucks. The unique truck-body, designed by Bazarian, is stocked with some \$1,500 worth of supplies. Each truck is a roving, quick-repair shop, equipped with four side-compartments whose hinged doors are secured by locks.

Compartment #1 holds 50 types of solvents, traffic waxes, cements, adhesives, and abrasives—all neatly stashed in gallon containers. Compartment #2 is a treasury of miscellaneous construction materials: screen and cove moldings, dowels ($\frac{1}{2}$ to 4 in. dia.), shelving (4 to 5 lengths of standard, 8-ft. shelving), and structural wood (2 x 2s, 2 x 4s, 4 x 4s, and 2 x 3s). A third compartment stocks builder's hardware—everything you can imagine and then some. Cartoned in gross lots are turn bolts, box bolts, service bolts, sash operators, casement fasteners, and cupboard catches. Each truck's fourth compartment holds electrical supplies, a complete chest of fasteners, a sizeable array of electrical hand tools. In addition, each of Freddie Fixit's rigs carries three cases of window glass (about 50 sq. ft. per case); a 6-ft. step-ladder, 20-ft. extension ladder, a couple of folding sawhorses and a 500-lb. capacity hand dolly.

Bazarian's rigs are a vast improvement over the '39 Plymouth station wagon with which he began business four years ago. He figures that, counting the truck's cost, each mobile shop now represents a \$4,000 investment.

At 8:15 a.m., with work orders in hand and the necessary supplies aboard, we pulled away from Freddie Fixit's yard, outbound for the day's first job. The driver phoned ahead (as he does before every job) to make sure we were expected.

At 8:30 we arrived at a West Los Angeles home. The fixit man removed two screens which could be more efficiently repaired at the shop, and carried them to his truck. Then he rehung a front door (\$3.50), installed glass in a back door (\$3.95), freed a couple of stuck windows (\$3) and cemented around a backyard clothes pole, mixing a little batch of cement especially for the job. Cementing cost the customer \$5. The craftsman picked up a playpen, carted it to the truck, and billed the customer \$15.45, which did not include shop-scheduled repairs on the screens and playpen. The householder probably would have been charged \$50 had she called craftsmen narrowly specialized in each of these jobs.

At 9:30 a.m., we reached our second stop. Here the fixit man spent 40 minutes installing two iron anti-burglar bars at a living room window (\$8.95 each, these bars are specially made up to fit customers' windows). Forty minutes of skilled repairs were billed at \$17.90.

Fifteen minutes later we picked up a chair which needed regluing. My driver quipped, "Freddie Fixit loves 'leaners.' They're always breaking chairs." From 10:30 until noon the craftsman busied himself at still another house installing weatherstripping around three exterior doors, charging \$6.50 for each opening.

An hour out for lunch and we were on the road again, this time stopping to pick up half a dozen bird cages (and to deliver three repaired ones) at a pet store. "Freddie Fixit" finds bird-cage repair, including clean-up and repainting, a profitable item and many pet-stores engage him. Cage repair was billed at \$3 each.

From 2 to 5 p.m. the fixit man worked at top-speed, rehangng an apartment building's four heavy garage doors. The customer got a bargain at \$10 per door.

Our rig pulled into "Freddie Fixit's" yard at 5:15 p.m., having billed \$100.85 worth of work, not counting several items returned to the shop. It was a day well spent—grossing considerably more than the average, old-style fixit man expects to take in weekly.

Freddie Fixit's other craftsman had likewise worked a busy day. He'd installed 40 sq. ft. of utility shelving (at \$1 a running foot, including brackets and service charges) and had trimmed



Advertising has been one of the cornerstones of Freddie Fixit's success. You can't miss this sign as you drive past his place on Los Angeles' Pico Boulevard.

the bottoms of six doors (at \$2.50 per door).

Back at the shop, Bazarian got to work on the kiddies' playpen and the unglued chair. He seldom goes out on repair jobs now, instead devotes half his time to the shop, the rest to estimating special projects. Typical of these special assignments—which Bazarian calls the "real cream of this business"—was his design and installation of a transparent plastic wind-guard to be placed around a swank Hollywood swimming pool.

Orthopedic fixtures, another specialty, demand inventiveness. Recently he rigged a bathroom with special railings and hand-holds so a cripple could shave himself while standing before the mirror. When a valuable sacred statue toppled from a

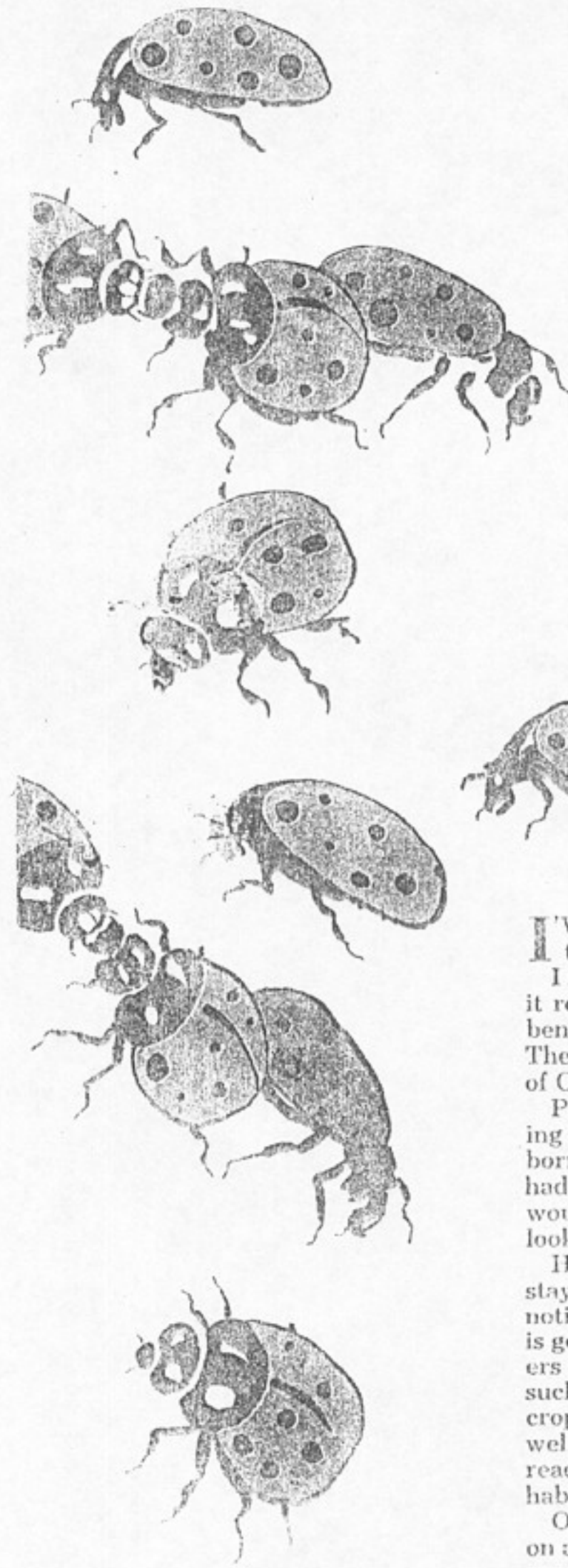
church's banister, Freddie Fixit replaced the bronze fingers with such expertness that the fracture defied detection.

Although the better money is in these specialty assignments, Bazarian spends a lot of time sharpening scissors and lawn mowers and repairing appliances—which are, of course, the old standbys of the fixiting trade.

As Bazarian set to work on what his craftsmen had brought in, he had at hand a complete shop. The two-room layout included an appliance-repair bench, a spray booth, furniture refinishing section and rescreening bench. "Freddie Fixit's" shop, an orderly array of \$1,500 worth of tools, boasts a ½-in. bench model drill press; an 8-in. circular saw; 24-in. jig saw; a 6-in. bench grinder for tool sharpening, and a 6 x 36-in. belt sander. There's also a 12-in. disc sander, and a mammoth chest of wood-working tools. The paint spray chamber is equipped with a 65-lb. gun and a revolving platform.

All this Fred Bazarian has amassed from a modest beginning. It was achieved because he had a keen insight into what was wrong with the fixit shops he saw around him. He early decided that his was a "home-service community"—whose householders expected the repairman to drive to their doors, ready to do a half-dozen different jobs with the expertness of a journeyman craftsman.

It's a simple formula, accented by hard work and business astuteness. With just such ingredients you too can set-up in your own community as the fixit-man. Not the old-style tinkerer, mind you, but as today's most versatile home repair specialist, the fixiter.



I RUN A MAIL-ORDER BUGHOUSE

Ladybugs are far from ladylike when
it comes to ruthlessly getting
rid of crop-destroying insects.

By George C. Quick
as told to Jack B. Kemmerer

I'VE developed a new weapon to combat the insects that plague the farmer. It's the ladybug.

I say "new," but the ladybug isn't really new. In fact, it received its name during the Middle Ages when the benefits from its aphid-eating habits became known. The insect was dedicated to the Virgin Mary as "Beetle of Our Lady."

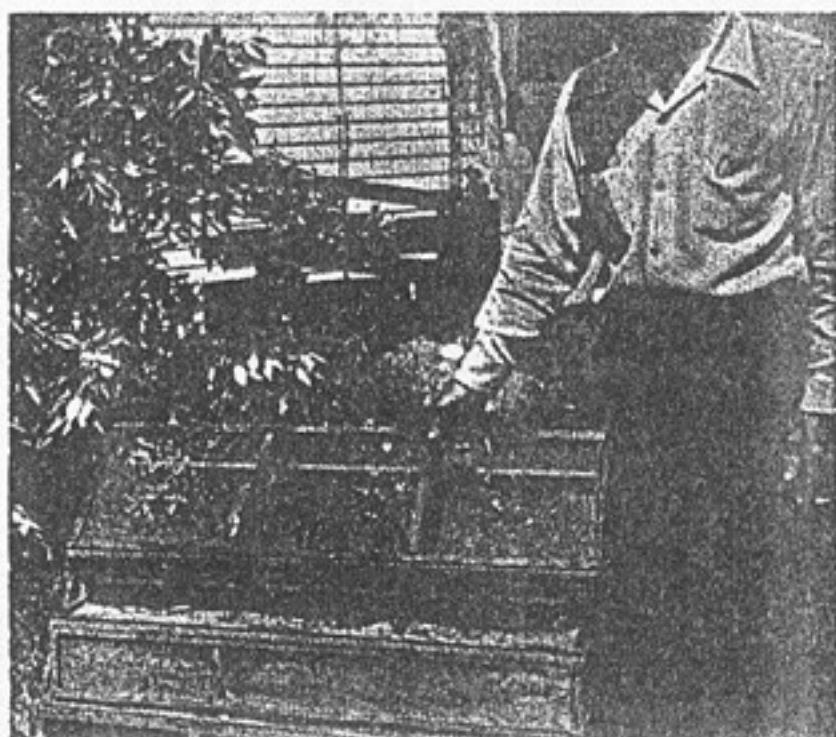
Prior to my interest in ladybugs I dusted crops, moving around the country for almost 11 years taking airborne jobs wherever they were offered. Then, in 1935 I had a crack-up and decided then and there that my eyes would no longer permit me to dust crops. So, I started looking for a new job.

Having worked with farmers for so long, I wanted to stay with them in some manner. For some time I had noticed that the ladybug was not the peaceful insect she is generally thought to be, but one of the toughest fighters in the bug world. She eats any soft-bodied insect such as aphids, mealy bugs, worms and the eggs of these crop-consuming insects. Ladybugs, I thought, might well be in my future. Beginning extensive research, I read everything available and studied the insect's habits.

One day, when fishing in the mountains, I stumbled on a swarm of about 1,000,000 ladybugs and then noticed several other swarms in the area. I managed to gather about 50 gallons—6,500,000 bugs—and brought them home where I stored them in our spare bedroom. During the night, one of the sacks became untied and by morn-



New cardboard carton developed by George Quick, left, has screen wire at each end and strips of corrugated paper inside for storage and safe shipping.



Three sectional wire cages filled with coarse excelsior are taken into the fields in order to gather the ladybugs where they are swarming.



Two and a half gallons of ladybugs can be packed into one of Quick's cartons—and as each gallon holds 130,000 bugs, that's 325,000 to a carton.



Prospective customer, right, inspects samples in small aerated containers. Quick expects to sell over one billion ladybugs this year.

ing the ladybugs had taken over the house. My wife even found them on the baby. I thought my ladybug career was ended right there. However, I sold the remaining bugs to farmers in the immediate area, receiving \$2.50 per gallon.

A survey of various crops showed that a lack of balance existed in the fields because farmers sprayed their crops to kill parasites, but in doing so also killed the ladybugs. After spraying, aphids moved in and as there wasn't anything to stop them, they destroyed the crops.

It was apparent that successful use of ladybugs depended on their availability when the farmer needed help with his crops, usually in the spring. But, the ladybugs hibernate in early fall and that is the best time to gather them as they are swarming in groups of millions. The problem was to keep them until spring.

Locating a dale in the mountains where the bugs were swarming, I put them into wire cages and left them for the winter. Upon returning in the spring every bug was dead! I later discovered that they weren't hibernating but merely taking a rest which they do periodically. They hi-

bernate at lower altitudes where it isn't so cold.

So, due to inexperience, my first year in business ended with a loss of \$750. Continuing to experiment, though, I put a swarm of ladybugs in cold storage. At the end of three weeks most of these bugs were also dead.

Gathering another swarm, I packed them in a cotton sack filled with pine cones. After ten days in cold storage I opened the bag and placed a few bugs on a table with a few drops of water. They immediately began to drink, proving that the humidity was too low. Spraying inside the sack with water, I returned it to cold storage. By repeating this at ten day intervals, six months later 90 per cent of the bugs remained alive and healthy. From this, I learned to vary the temperature to meet outdoor weather conditions, keeping it 10 degrees lower. However, I never let it get below 32 degrees or above 60 degrees. I repeat the water-drop test frequently, spraying whenever the bugs show signs of thirst.

I'm also experimenting with deep-freeze, but haven't had much luck. The first bunch I gave an instant



freeze from 80 degrees, kept them frozen for two weeks, followed by a fast thaw. Ninety per cent of the bugs were dead. I am still experimenting and believe that eventually deep-freeze will be the answer and that bugs will keep indefinitely without care.

At one time I kept several small containers of ladybugs in the family refrigerator for various tests. One evening we had some friends in for dinner and as we sat down at the table I saw my wife staring at the salads. Much to her horror and embarrassment several of my test ladybugs were crawling around on the guests' plates. Now, I have a refrigerator of my own.

Packing for both storing and shipping was the next problem to be solved. Everything was by trial and error, and I lost millions of bugs due to improper packing.

If ladybugs are packed solid, they will die. Each bug must have some sort of footing and even if packed loosely they will clump and die. I discovered this by studying the swarms—even though millions of bugs swarm together, each had some place to rest its feet.

Until recently, I used cotton sacks filled with pine cones as the cones offer ample resting footage for the ladybugs. However, because the bags and cones aren't always available, I have developed a cardboard carton that has proved satisfactory. These boxes have screen wire at each end and are filled with corrugated cardboard which furnishes footing. If neither sacks nor boxes are available, leaves and twigs from the bugs' natural environment can be used. Also a heavy, coarse excelsior is satisfactory.

For long distance shipments we use air express and otherwise, parcel post. I never receive a complaint that the bugs are dead on arrival now.

The proper gathering of ladybugs is important and you must know the right places to look. I have located numerous spots in Arizona where they swarm by the millions and have found as many as 300 gallons on one acre. They swarm in low trees and bushes and are easy to shake off on large cellophane sheets. These sheets are used because the bugs can't get footing on the smooth surface and slide into buckets easily.

Ladybugs swarm at different times, depending on the locality: in California it's late May and early June; Arizona, in July and August; Idaho, in the early fall and spring with the same in northern Utah. The ladybug is found in every state.

If you're interested in gathering ladybugs, follow very carefully the suggestions given as

to packing and storing. One of the greatest dangers is excessive heat. Once, I made a large shipment to a farmer in Amarillo, Tex. It was pretty cold when the bugs arrived so he put them near a large stove. In a few hours, most of the bugs died.

Four people gather the ladybugs for me the year round. During the local season, I have as many as 16 ladybug prospectors. I sell the bugs for from \$5 to \$12 per gallon, depending on the cost of gathering and storing. The current price is about \$7.50 per gallon.

Most farmers, aware of the ladybug's value, are anxious to have them. However, now and then a farmer has to be convinced. One local grower had 50 acres of lettuce which were being destroyed by aphids. I told him about the bugs but he didn't believe they would help. So, one day I took a small carton to his farm. We went to the field where the aphids were thickest and put a couple of ladybugs on a head of lettuce. The instant the bugs touched the lettuce they started eating aphids. The farmer was amazed.

He ordered 25 gallons.

I have an order right now for 2,000 gallons from a wheat farmer in Liberal, Kan., 1,000 gallons from a farmer in Oklahoma, and a group in the Texas Panhandle has offered to buy my entire output each year.

Until this year I have used this business as a profitable sideline, averaging from \$3,000 to \$6,000 a year for a couple of months' work and an investment of about \$500.

However, this year I am going into it full time and on a large scale. I have delivered 4,000 gallons to date. With the orders on hand, I expect to sell more than 10,000 gallons—around 1,300,000,000 ladybugs—this year, with a gross business of \$75,000. Plans are already drawn and construction will soon begin on a modern \$20,000 cold storage plant for keeping the ladybugs available when the farmer needs help with his crops.

So, my mail-order bughouse has really turned into a serious proposition. Not too serious, though. Whenever I feel that I'm taking things too much to heart, I think of the farmer's mother who came out to inspect my bugs. She brought her granddaughter with her.

The little girl looked at the ladybugs very closely. "What're those, grandma?" she asked.

"Those are ladybugs, honey," the bespectacled grandma replied.

The little girl, squinting her eyes, dropped to her hands and knees and stared at the bugs.

"My, grandma," she said puzzled. "You sure don't need glasses. I'm a lot closer than you and I can't tell if they're boys or girls." •



Market Place for the Nation's Craftsmen

SCIENCE AND MECHANICS

FEBRUARY, 1953

By DOUGLAS J. INGELLS



A trio of woodworkers, Mr. and Mrs. E. Fisher and E. Schurter, make wood novelties such as the bird houses, toothpick and pretzel holders shown here.

IF NINA and Earl Stewart of Frankfort, Indiana, have their way, every home craftsman can share in their new enterprise, *Homecraft House*. The Stewarts are starting a coast to coast chain of stores displaying the unusual and exclusive items that people design and build at home. Here's how it is actually working out.

The Indianapolis store has a clean, cheerful look, is located in a relatively low rent district, and not hidden by larger buildings.

You first become a lifetime member of the Homecraft House family, cost \$10. This sum helps defray organizational and operational expenses. In addition, you pay \$2 a month to the store nearest your home to help pay clerks' salaries and cover upkeep; this entitles your products to be displayed in every community where Homecraft Houses are established.

Your craft item is stamped with your number, which goes on file; you set your own sale price. You can send in as many items, in as many varieties as you desire. At the end of each 30-day period a check is sent to you for the amount of your sales less 5%, which the Stewarts consider a fair share for their idea and services. Contrast this with the 40 or 50% markup usually made by stores who purchase merchandise from craftsmen; on consignment, most stores take a 20 to 50% discount, although a few go as low as 15%.

Some 375 checks are sent out by the Stewarts each month, ranging in amounts from 25¢ to \$150! They represent the harvest reaped by members of Homecraft House' two parent stores; one in Indianapolis, the other in Cincinnati.

Facts and figures indicate a bright outlook. Last April, for instance, the Cincinnati store, located at 6148 Montgomery Road, did \$10,000 gross business! The same month, the Indianapolis store which had been grossing \$4,000 to \$5,000 a-month, moved to 3423 North Illinois Street. Some 300 customers came for the "open house" and sales topped \$600 in one day!

It all began back about Thanksgiving time, 1950; the doctor said to Nina Stewart: "Your husband musn't continue working. If he does he won't live long!"

Since "Daddy" couldn't bring home the bacon anymore, Nina Stewart had to find some way to make a living. She remembered how much fun she had making fancy baby shoes when Jan Ella,

their daughter, was a tiny tot. And she recalled from days when she was an infants' wear buyer for department stores how much demand there was for exclusive baby clothes.

So, she started stitching pieces of pattern-cut felt into trim, neat, decorative baby booties. Then she sold them wholesale for \$1 a pair to stores in Fort Lauderdale, where they were living. The stores bought them by the dozen which was about a day's production. The stores retailed them for \$1.79 to \$1.98 depending on design and colors.

The big mark-up price and profit which the stores made, caused husband Earl do some overtime thinking. He didn't feel it was quite fair, even though he was well aware of the high cost of merchandising. He felt there should be some way to realize more profit from the hand-made booties which his wife had made.



Tom Reedy, who has an industrial job making freight elevators, also likes to build radios into early American style cabinets. Note the homelike atmosphere even though this is inside one of the Homecraft stores.

Why not, he reasoned, set up a store, and sell booties directly? And surely, there were others who enjoyed making things, and who needed additional income. Such people really needed a place to display their products. The Stewarts read hundreds of craft articles in dozens of magazines. It was evident there was a vast hidden production line for items of every imaginable kind.

Then Earl had to go to a hospital. They decided to move back to Frankfort, Indiana, near the Cold Springs Veterans Hospital in Indianapolis. Mrs. Stewart kept right on making the booties, building up a backlog while her husband worked out a plan for opening the store. In the spring of 1951, Earl was released from the hospital. He and Nina decided to sink their life's savings—\$2500—into Homecraft House in Indianapolis.

First, they ran a small ad in the Indianapolis newspapers, outlining their plan to display hobby

items and other home-made articles in a central store. It asked that interested persons come for an interview at the Lincoln hotel. In two days, 17 persons showed up, representing a variety of crafts from ceramic jewelry to aprons. They all wanted to join. "It was very encouraging," Nina says. "These people seemed more excited about our plan than we did ourselves. They wanted to give us the initial \$10.00 fee right then and there!"

At that first meeting the Stewarts didn't accept any memberships; but they asked the applicants to come to another meeting at the YWCA the following week. All of them showed up. When they left, Homecraft House had \$160 for its bank account and 16 shareholders. To make the idea work would take a lot more than just 16 faithfuls. The Stewarts realized this. The key to their success would be to have a much greater

variety of exclusive things, "different" products you couldn't buy elsewhere.

The next three months found the Stewarts virtually canvassing house-to-house to see what people were making in their spare time. Here and there, they picked up a new member. But it was slow. They went back to their original technique. In three weeks they rented hotel rooms in Kokomo, Anderson, Muncie, and Lafayette. In these cities they placed the ad in the local papers. Counting travel and personal expenses their outlay hit approximately \$370! Homecraft House was \$210



Mrs. Hazel Staten, a homecraft house member, makes brightly colored stuffed animals and Mammy dolls that serve as broom covers.



Another member of Homecraft House, Mrs. Gladys Lett, makes these attractive figurines and sculptured porcelain clocks and lamp bases.

in the red before it even started. And the trouble was just beginning. Fall came and there still wasn't a store. But they had 75 members. Meanwhile, many members who had invested their money sent in new memberships from friends.

"This trust and faithfulness," Nina asserts, "is what kept us going. We just couldn't give up. Finally, we decided to open a store with a minimum membership to see what would happen. Maybe, once the business got going it would grow."

They rented a seven-room house on North College Street for \$100 a month; four rooms downstairs were refurnished as a store. The Stewarts put in shelves; did the painting and decorating. Nights, they wrote letters to members telling them to send in their products. Craftwork that arrived took the shape of baby clothes, dolls, figurines, clocks, mantle pieces, dishes, pottery, ships in bottles, lamps, wooden shoes, ash trays, cocktail tables, doll furniture, knick-knacks, stuffed dolls. "We took inventory," Earl explains, "and found there were items ranging from 10¢ sale price up to \$37.50. We must have had a stock value of nearly \$3500!" It meant getting insurance to cover fire, theft, or damage to the products. The employees had to be bonded, although Earl and Nina planned to do most of the work. They hired a lawyer and a bookkeeper.

People from the Better Business Bureau came around to see what was going on, checking as a result of the ads. They gave the Stewarts a clean bill of health. There was also a man from Dun & Bradstreet, who startled Mrs. Stewart when he explained he'd list them as "N.Q.". When he saw her puzzled expression he said: "It doesn't mean N.G. (No Good) but simply—not quoted!" In addition, there was the matter of government sales tax. Finally, everybody was satisfied and Homecraft House was ready to open.

Then, the roof fell in. The site they had selected was turned down by the City Planning

Commission—not zoned for business! But, to counteract this disaster, there was a ray of hope. A hobby show at the State Fair Grounds was scheduled to open the following week, and the director of the exhibits had heard about the Stewarts' novel idea. He talked them into renting a booth at the Fair Grounds at \$100 per week! Before the booth closed they sold more than \$500 worth of their items, and acquired enough new members to boost the total to more than 150!

Encouraged by this, they rented another store, and opened November 29, 1951. Customers only trickled in, and business was bad. The reason? The store was "boxed in" so that adjoining stores hid it from the street. "You must get a good location; that's very important," Earl points out. "It should be in a small business section of a neighborhood. A good idea is to get on a busy thoroughfare, preferably an alternate highway route. The front of the store should be right up on the sidewalk since the unique offerings on our shelves entice tourists."

A homecraft house like this should sell itself by appearance. Bright, cheerful, carefully chosen colors make a store that sells everything, appear exclusive, friendly and not contrived. The interior of the Indianapolis Homecraft House looks like a large living room, with shelves of different sizes and shapes, some that even look like cupboards or buffets. That's to put the customer at ease and show off the little knick-knacks in their natural environment.

Take an item like lamps. The Cincinnati store displayed 20 different lamp designs by five craftsmen, arranging them on tables (also built by members) as they would be placed in a living room; some lamps were lighted to display other members' shade designs. To see them all you had to move about the entire store.

In one corner of the Indianapolis store was a hand-carved "corner table" (\$12.50), which displayed an embroidered doily (\$2.50), a gaily colored ceramic ash tray (75¢), and a leather-stitched cigarette case, engraved in gold (\$2.75). Four items for sale, but displayed as you might find them in your own home.

The Stewarts have already found a wide variation in geographical buying habits, with items that sell in Indianapolis not selling at all in Cincinnati. As they branch out to other locations, they'll find these differences in buying habits even more marked.

What's the Stewarts' yardstick? They buy the papers in the community where a store is located, scan the classified sections to see what people have to sell. Then re-check to see which items sell the quickest. When they find a particular item that seems to be going well, they feature similar merchandise. In addition, Earl or Nina scout the counters in the big stores, to watch people's reactions to different displays and see what they are buying. Then they use similar items from their own stock as come-ons.

Here's how they sparked customer acceptance of slowly selling Mexican figurines. An issue of

Holiday magazine about Mexico had page after page of color photos. The Stewarts bought three copies, placed them open on the table with the figurines. The miniatures almost duplicated the characters in the magazine photographs. They were all sold out the next day!

Homecraft House does little advertising, concentrating on small neighborhood newspaper ads to get more members. "Because we're small," Earl explains, "we can't afford to pay big paper rates and, besides, they don't help us too much, anyway. Our little ad is lost among the big display ads. But in the smaller weeklies we definitely get results."

Right now, Homecraft House is starting a series of ads to plug the individual hobbyists, not the store. Under a small picture of a hobbyist with his or her item, they run a short story about how he got started in his hobby. Near the end of the story will be short descriptions of other items on sale at the local store. This double-barreled ad-



Mrs. Gene Scherner, an occupational therapist, tools a decorative leather sandal.

vertising brings them both store customers and new members.

The Stewarts have made so many friends that they get letters from distant places from patrons who want to buy items by mail. When they get these orders the letters go to the individual craftsmen for filling.

"We had one member

Here the Rev. Richard Wenger holds a wall bracket he made. He also fashioned the lamp base at right from a bowl and old-fashioned pitcher.

in the State of Washington," Earl laughs (all out-state members belong to the mother store), "who sent us one of the most unusual lamps I've ever seen. It sold the first day—\$29.75. The buyer wanted a mate. We wrote to our member and asked him to make another one just like it.

"Gosh, Mr. Stewart, I'm sorry," the craftsman apologized, "but I don't even remember what that lamp looked like. Will you have them send me a picture of it and I'll try to make another."

Sometimes the Stewarts get a membership fee by mail. Later, the product comes in and turns out to be comparatively mediocre. "Naturally, we can't turn down the item," Earl says. "That would defeat our whole idea. But we put these less attractive items in the second-row display." Where products were very inferior the Stewarts have written builders expressing their regret at having to turn down memberships. But these are rare exceptions.

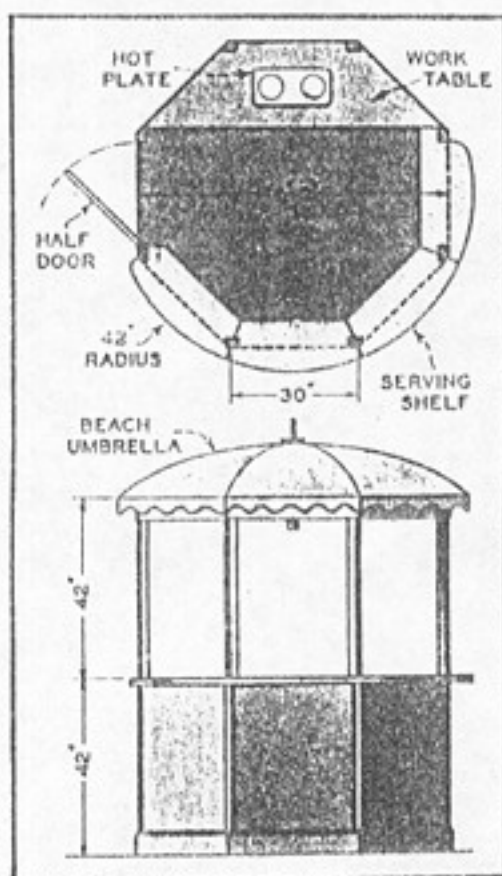
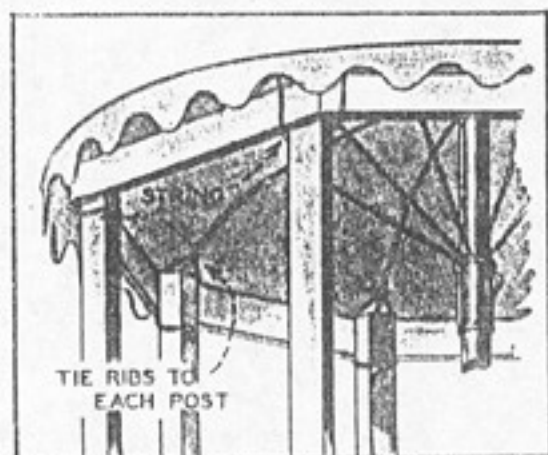
The idea has even spread abroad. A countess in one of the Scandinavian countries wrote the Stewarts asking for membership. She wants to sell her hand-made throw rugs.

The Homecraft House that Nina's baby booties built is rapidly gaining fame. Already persons in Detroit, Dayton, Hollywood, Chicago, New Orleans, and many other cities have written in. The Stewarts want people everywhere to become interested in starting branch stores. The more stores they can get and the more members, the better the idea will work for everybody. For particulars write to Earl or Nina Stewart at the store, 3433 North Illinois Avenue, Indianapolis, Indiana. The Stewarts set up the stores and handle business details of rent and operational expenses out of membership and dues funds. They are looking for competent managers, who must also be members and producers. Managers and clerks are cautioned never to press a sale. That's why customers browse around—and usually end up by buying something before they leave.

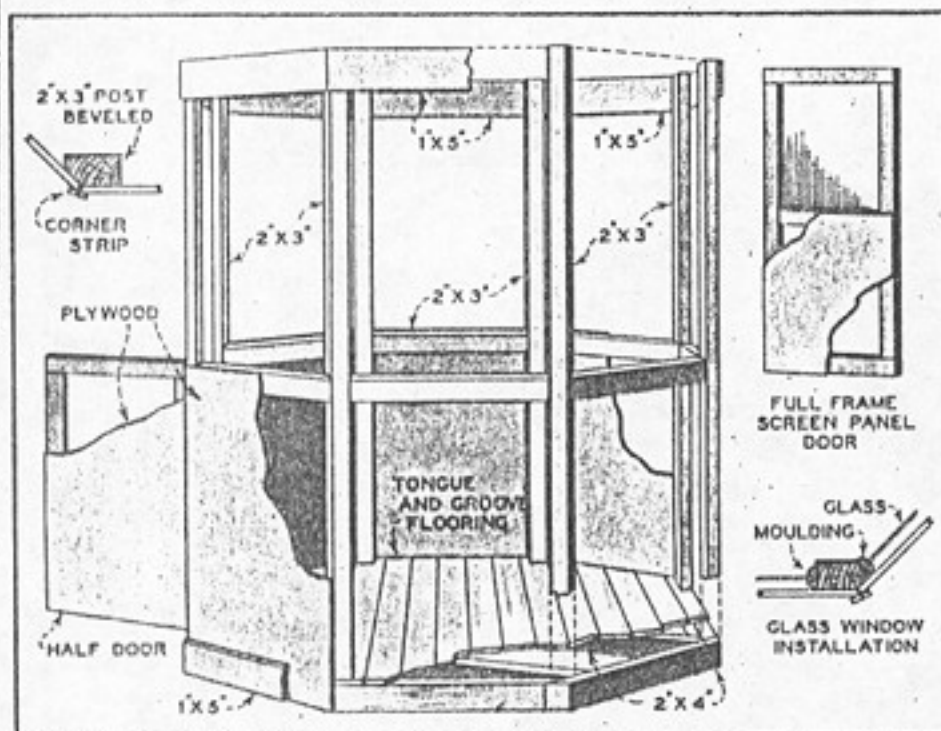




Here's a simple, inexpensive little "drive-in" that will produce a nice profit if suitably located.



Roadside Money Maker



Though designed essentially for construction and operation by youngsters of high school age, as examination of plan, dimensions and construction will show, this booth could be elaborated upon to rate as a real adult business proposition.

WITH a second-hand beach umbrella, odd pieces of used lumber and linoleum remnants (if you can't get waterproof plywood or composition board) a neat little refreshment booth can be built to dispense hot-dogs, soft drinks or home-grown products.

Obtain the umbrella first and adapt the structure to it. A conventional beach shade is 7 ft. in diameter, and with this the floor plan should measure 6 feet across, being octagon in shape. The floor boards are laid on two-by-fours and the upright posts, 2-in. by 3-in., are beveled 45 degrees on one corner, as shown in the sectional view. If glass is to be installed, the posts must be beveled on two corners so that the pane abutts at right-angles to the bevel.

On four sides install a curved serving-shelf scroll-sawed on a 42-in. radius. If the booth is open, a half-door is satisfactory, but if glassed-in, make a full frame with either glass or screen in the top panel. Shelves can be located inside to meet individual needs. Below the shelf install panels of whatever material is available, linoleum, wall board or plywood. A paint job in white with brown and black dogs on the lower panels will catch the eye of the prospective customer. The umbrella is anchored with cord tied to each rib and the post beneath it.

—Hi Sibley

Spiders Spun

By Louis Hochman



That big Black Widow in the jar has no terror for Mrs. Songer, who finds this "menace" the nicest spider in her parlor.

Mechanix Illustrated

October, 1949

Her Career

Meet a housewife who lives on the cobwebs in her home—and just loves Black Widows.

"COME into my parlor," said Mrs. Nan Songer to the big spider who sidled up beside her at her home in Yucaipa, Calif.

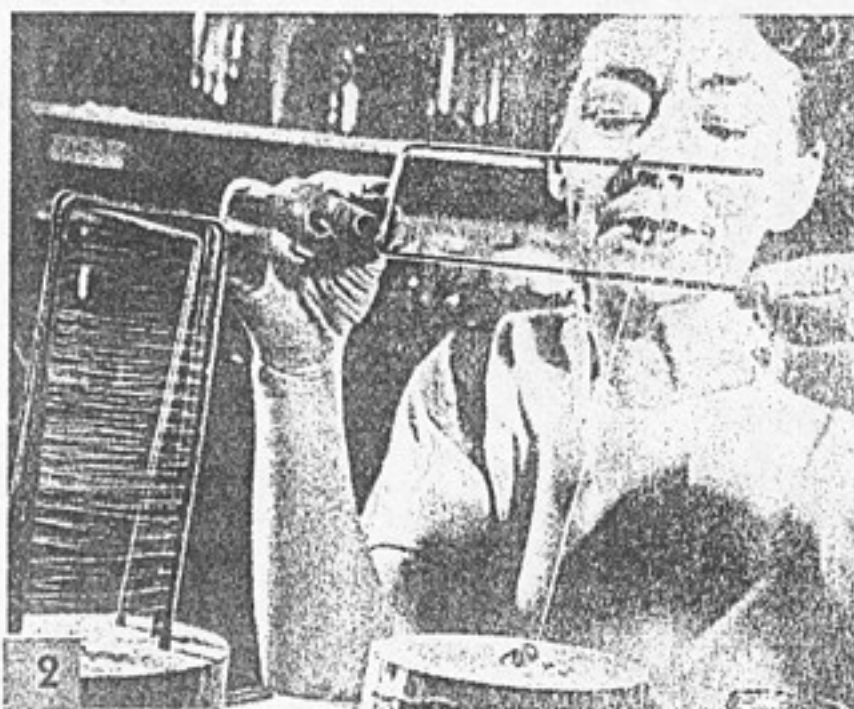
Because she not only refused to follow in Little Miss Muffet's hasty footsteps but invited the spider into her home, the insects now are busy repaying Mrs. Songer for her kindness by spinning her the oddest career in the country—cultivating cobwebs, right in her own home. Every day her brood of more than 50 spiders turn out hundreds of feet of fine silken strands that she sells to manufacturers of precision optical instruments. These clients use the delicate cobwebbing for cross hairs in gunsights, bombsights, surveyor's transits, periscopes, observatory instruments, and other scientific apparatus.

It all started 11 years ago when Mrs. Songer, who was fascinated by the friendly spider, got interested in collecting other spiders and moths, butterflies and crickets. She studied their habits, then reported her findings to the Smithsonian Institution in Washington, D. C. Before she realized it, she had built up a reputation as an authority on bugs.

When war broke out in 1941, the U. S. Bureau of Standards asked her:

"Can you produce high-grade spider web in quantity?"

Mrs. Songer said yes, she could—and has been doing it ever since. Her spiders played a vital part in winning the war on all fronts, since they made it possible to mass-produce optical instruments of great precision.



1 Mrs. Songer gently pulls the Black Widow from a bottle to silk the expensive spinner on top of a soft block of yucca wood.

2 After pinning down the spider with a staple and tickling its spinnerets with a needle, she winds the web on a frame.

3 To check her spider's spinning condition, she dons a pair of homemade magnifying glasses and uses a tin-can light, right.



4



5



6



7

4 That's no weird hubble-bubble the spider woman is smoking but a gimmick for sucking up fruit flies to feed to her charges.

6 Baby sitting for spiders is the chore Mrs. Songer is doing here as she watches the newly hatched ones swarm over the bottle.

Today, she has a parlor full of healthy, contented spiders. She keeps them in cloth-covered jars and screened-in cages and segregates those species like the Black Widow, that don't get along well together, into separate bottles. A little dried shrubbery, thrown into each jar, gives the spiders enough support to build their web homes. But this is not the web Mrs. Songer sells. That's drawn directly from the spider at the right time and carefully wound around wire frames for the manufacturer in individual strands up to two inches in length.

Since most spiders spin brittle, cottony stuff, Mrs. Songer uses only those breeds

5 Ten wire frames, each spooled with cobwebs, go into special dust-free packing boxes for shipment to manufacturers.

7 Using a bottle as a trap, she calmly goes after a spider for another spinning job. Groups of spiders live in that shrubbery.

that yield a strong, elastic web of consistent quality and thickness. Top workers in her spidery are the Golden Garden, the Green Lynx and the Black Widow.

"You needn't be afraid of the Black Widow," she assures. "It's one of the most friendly spiders—never bites you unless it gets hurt. I've handled them for years and never had an accident."

Poisonous or not, Mrs. Songer always handles her spiders with tweezers. She grasps them firmly by the legs but takes care not to pull off their legs.

To milk the spider of its web, Mrs. Songer transfers the creature to a soft yucca block. Then she pins the

spider down with a large staple passed over its body—much as a cow is pinned in its stall for milking. The spider's legs also are clamped down to discourage its annoying habit of reaching behind and breaking off the silk strand.

With a dissecting needle, Mrs. Songer tickles the spider's spinnerets until it starts giving out the silk. Next, she attaches the strand to the end of a freshly shellacked rectangular two-by-eight-inch wire frame and carefully winds up the webbing. It takes 54 turns, or nine feet, of web to fill a frame. Mrs. Songer sells this web to her clients for \$25 per 100 feet.

An adult spider will produce 100 feet of web at a silking, while younger ones will give only 50 feet. Mrs. Songer can silk her spiders every four days. To prepare her cobwebbers, she feeds them well for two days. Then she takes them away from food for two more days to remove any impurities from their systems and insure clean strands. After yielding around 1000 feet of web, the spiders usually die.

Ordinary spider silk is about one-fifth the diameter of human hair. Because of the web's strength, elasticity and ability to withstand high altitudes and sudden temperature changes, it's ideal for precision optical instruments and allows them to be used on land or sea or in the sky in any part of the world with no variation in their delicate spider-line accuracy.

Fine as the usual strand is, however, Mrs. Songer often gets orders for even finer web. She then goes to the baby spiders for her silking. When thinner strands are needed for the most precise instruments, she splits the baby spiders' silk into strands that are almost invisible to the naked eye. She can, and frequently does, split strands down to 5/100,000ths of an inch. For this microscopic work, she prefers the web of a six-week-old Green Lynx spider.

Her splitting technique is based on the anatomy of the spider's spinning machinery. The silk glands of the spider are clustered like grapes inside the tip of its body. They connect with the spinnerets at the tip. Inside the glands, the silk is in a liquid state. Upon contact with air, this liquid turns into webbing. To split the web, Mrs. Songer keeps snagging at the silk exuding from the spider's body with a dissecting needle until the web separates into more strands. She pulls these apart without breaking.

For web strong enough to use in high-altitude bombers, she twists three to five strands of Black Widow silk into a single

strand. For this neat trick, she uses a home-made gadget that weaves the silk together as it exudes from several spiders at the same time.

Each captive spider's strand of silk is attached to a knob on a wheel of her gadget. She rotates the wheel and slowly draws away from her spiders to twine their strands uniformly into a single heavier one.

With each type of instrument demanding a different kind of web, Mrs. Songer must keep at least 50 working spiders on hand at all times. During the summer she works the Green Lynx and Golden Garden spiders. As these adults die in the fall, she uses their young, and the Black Widow spider, for winter work.

Operating costs are practically nil. Mrs. Songer feeds her spiders insects that are plentiful and easy to breed. The bottles she uses as homes for her spiders are discarded food jars covered with cloth. The wooden shipping boxes for packaging the spooled web are expensive, since she had to have them specially designed. Manufacturers, though, return these boxes to her, so that she can use them over and over.

Mrs. Songer makes about \$200 a month from her spidery. Some small concerns buy an average of only 100 feet of web a year but larger concerns often buy 400 feet a month.

When there is a shortage of spiders in her plant, Mrs. Songer picks up her field glasses and a supply of small glass jars and goes off into the woods on a spider hunt. When she spots a spider through her binoculars she carefully snares it in a jar.

To feed her brood, Mrs. Songer breeds a mess of fruit flies in a large jar. At feeding time, she pokes a long glass-and-rubber tube through the gauze covering of the jar. With a small rubber hose attached to the other end of the tube, she sucks up some of the flies into the glass tubing. A cotton filter prevents the flies from being sucked into her mouth. She then pokes the glass tube into a spider's jar and blows out the flies—right into the spider's glass-bottle parlor.

At night when moths come beating on her screens trying to fly into the lights, Mrs. Songer is more hospitable than most women. She lets them in—then feeds them to her spiders.

The spider Mrs. Songer invited to "come into her parlor" didn't know what he was letting himself in for. Now Mrs. Songer has hundreds of other spiders in her parlor—all busy getting into shape, so that they can spin her a finer career in cobwebs. •

KING of the UNDERGROUND

Mechanix Illustrated

November, 1949

By George Scullin

EVER been told to "go out in the garden and eat worms?" Was the idea repulsive to you? It shouldn't be, for there are many people in the world who find the earthworm a wonderful delicacy—and a most wholesome food.

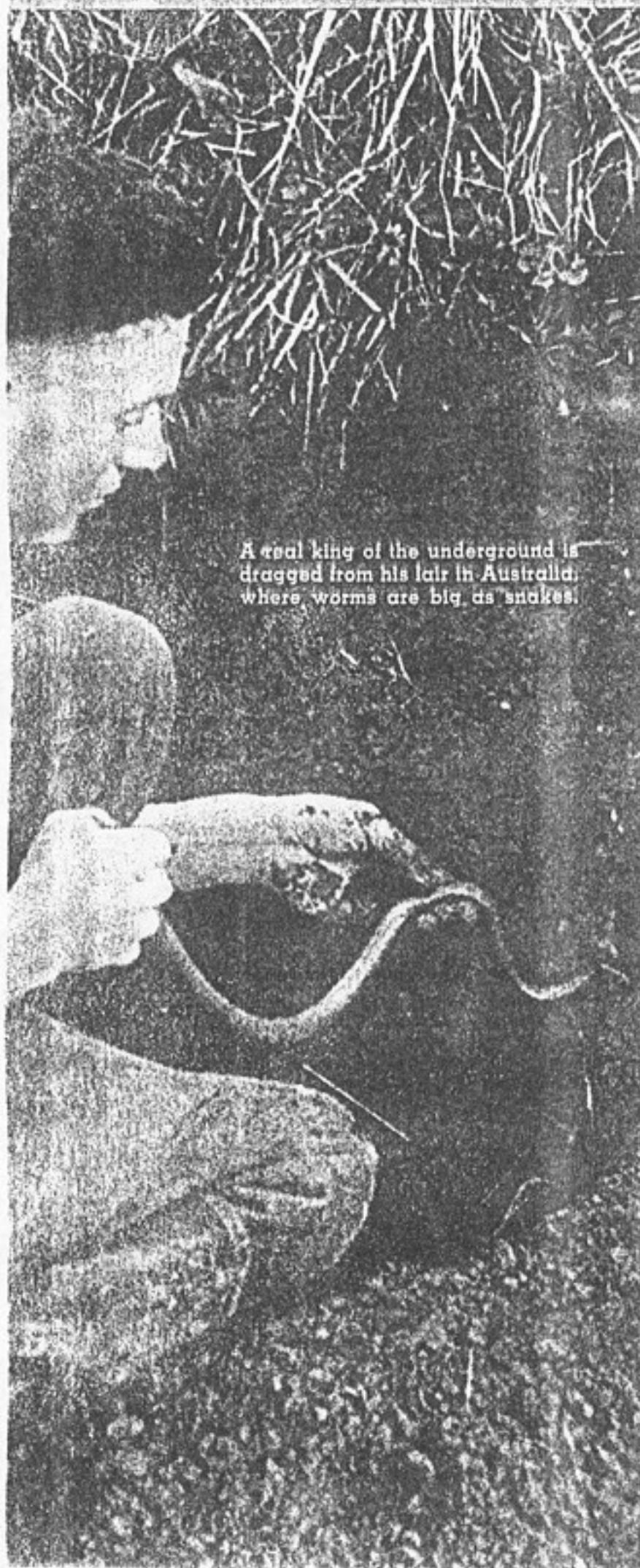
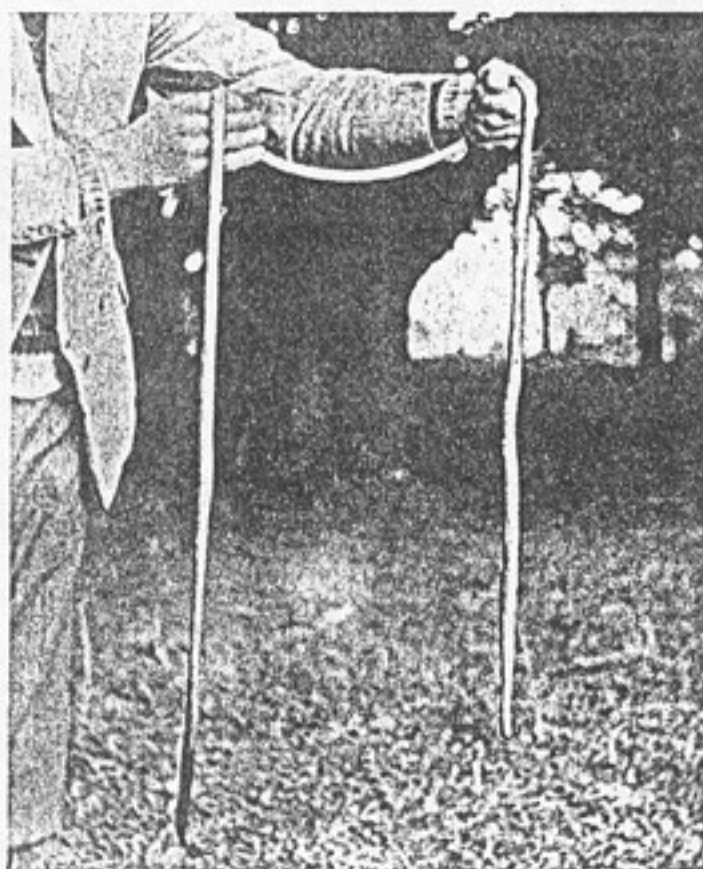
In New Zealand the Maoris serve a delectable dish that looks like noodles and tastes like stewed clams. The dish, of course, is literally full of worms.

In Africa several kinds of worm are eaten garden-fresh—raw. Explorers say they have a strong but pleasantly pungent taste. Two enterprising college girls, looking for new food sources for the Australian Institute of Anatomy, tried worms baked in ashes in New Guinea. Tasted like pork sausages, they reported.

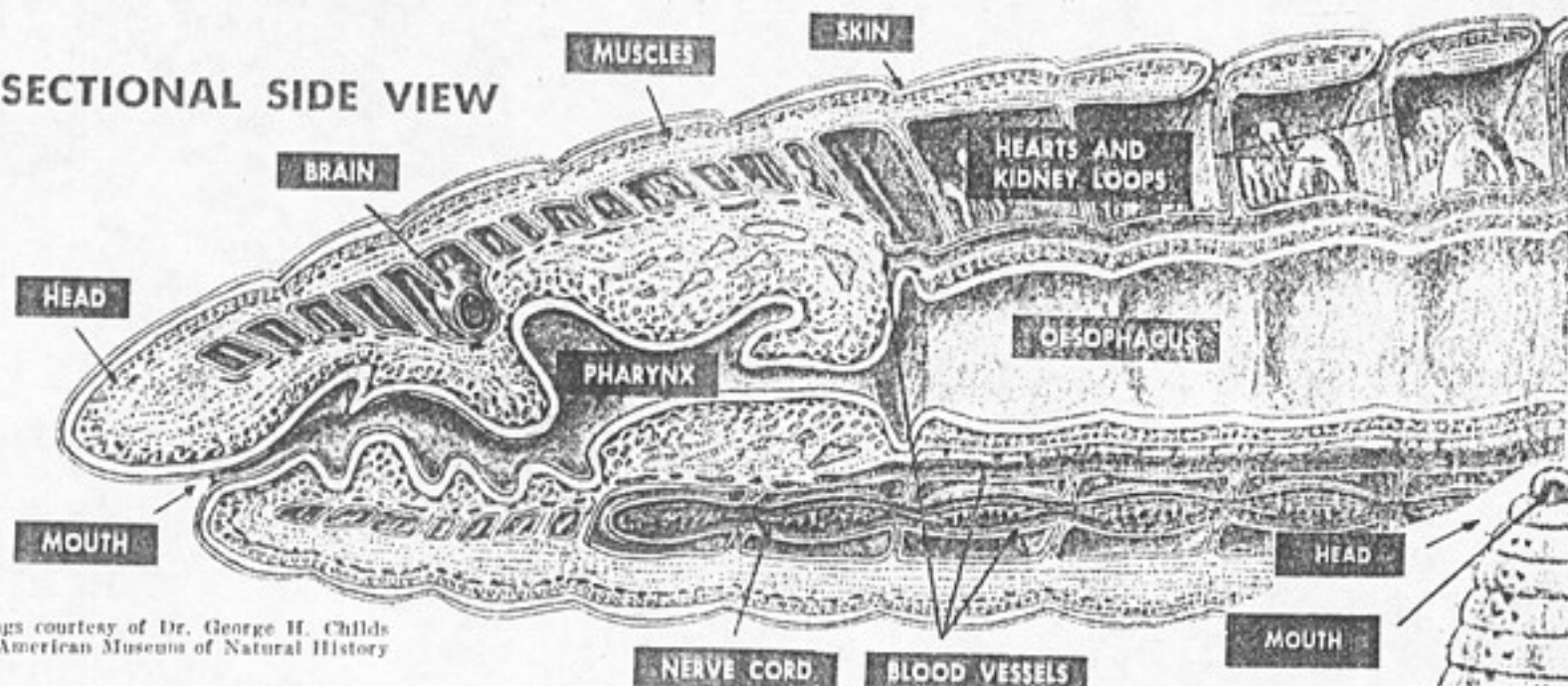
For centuries the Chinese have used fried worms as medicine—and wisely so, because the somewhat repulsive (to Occidental stomachs, anyway) dish is rich in Vitamin D. And who doesn't know how juicily delectable a worm looks to a fish? But the earthworm's edibility is only one of many far more curious characteristics of the

Here's eight full feet of squirming worm—the same giant that was being pulled from the hole, at left.

A real king of the underground is dragged from his lair in Australia, where worms are big as snakes!



CROSS-SECTIONAL SIDE VIEW



Drawings courtesy of Dr. George H. Childs of the American Museum of Natural History

double-ended, bi-sexual little crawler everybody knows but knows little about.

Scientists are well aware that for millions of years the earthworm has been a scientific farmer. By burrowing, it airs out the soil so it won't turn sour, and forms channels through which rain penetrates deep into the ground instead of running off the surface. Earthworms also fertilize the soil by dragging bits of leaves, grass and other debris as deep as a foot underground. Part of this serves as food but most of it becomes rich fertilizer through decay and bacterial action.

Some researchers assert that without the worm the ground would be packed hard as rock and could nourish neither tree nor plant. They argue that since all life on land depends directly or indirectly on green vegetation if man wipes out the worm he'll also wipe out the human race.

Because of the wonders worked by the worm in forming the soil for our forests and meadows, their importance to man's farming, however, has been exaggerated. Most experimenters find that worms actually are small help to the modern farmer who continually plows his fields.

When the plow breaks up a grassy meadow, the worm population may suddenly drop from a million an acre to less than a third of that number. Efforts to restock the soil with tons of fresh wigglers imported from earthworm farms do enrich the soil—but only temporarily, with their dead bodies. The worms simply don't like to live where the plow and the cultivator constantly threaten to break up their burrow homes.

The farmer shouldn't worry, though, when the worms vanish from his plowed fields. It would take millions of worms 50 years to turn over and air the same amount of soil he can till in a single day's plowing. And the fertilizer he spreads works far faster and better than the worm's slow

Anatomy of the common earthworm, revealed in the drawings above and at right, includes five pairs of hearts and kidney openings in all but three of the worm's 180 segments or "rings."

FEMALE GENITAL OPENINGS
(14th SEGMENT)

MALE GENITAL OPENINGS
(15th SEGMENT)

KIDNEY OPENINGS

BRISTLES BY WHICH
WORM MOVES

CLITELLUM WHERE
EGGS FORM

SEGMENTS 40-173
NOT SHOWN

UNDERSIDE VIEW

ANUS



enrichment of the soil by digesting or burying vegetable debris.

The private life of the worm has long remained a mystery, since this primitive character prefers to spend practically all its life buried out of sight in its vertical little mines. The only time the worm comes up to the surface is at night. Then it keeps its tail anchored firmly in its hole while the rest of its body squirms about for dried leaves, grass or any dead animals or insects in its range.

Before dawn, the worm snaps back in its hole and plugs the entrance with a bit of debris. For if morning catches the wriggler above ground, the sun's beam will turn into death rays for the king of the underground.

As fatal for the worm as the sun is a heavy night rain. The thirsty little miner likes the moisture and wiggles up from the ground to enjoy a good "drink." Then the down-pour loosens the soil around the burrow and washes the worm away from its hole.

Millions of these wandering worms are stranded far from home after such a rain and die in the morning sun or perish in the craws of eager early-birds. Some of the birds may accidentally drop a leftover worm into a rain barrel or water tank and thus back up the popular belief that worms "come down with the rain" or that they can squeeze themselves thin enough to wiggle their way through watertight barrel staves. The water itself cannot drown them since they have no lungs.

The personality of the worm is hardly that of a real live-wire. Though the little creature has plenty of heart—five full pairs of 'em—it has no eyes, no ears, no lungs and only a wide spot on a nerve cord for a brain.

Science says the earless worm can't hear—but still R. B. Bilkosky, a restaurant man in Alhambra, Calif., did teach his worms to come up for lunch when he whistles. He owns the Sure Strike Angle Worm Farm, which raises and trains worms for fisher-

men. Though the worm has no eyes, it does have in its segments photo-electric cells that are sensitive to light. Bilkosky took advantage of these cells to make his blind pets respond to light that shone in the burrows.

Every time he turned on the light he'd whistle. The worms squirmed out and he'd feed them. Then one day he found he didn't have to use the light. He'd just whistle and the worms wriggled up for lunch.

With what cells or organs the earless worms heard Mr. Bilkosky's whistles, nobody has yet discovered. But science has found out plenty about the mixed-up love life of the little wrigglers. Every earthworm is both male and female at the same

time. Many of the more than 2000 varieties can reproduce babies without mating. Most, though, prefer to ignore this self-sufficiency. They come up to the surface at night and mate by contact.

You can find earthworms all over the world, even on the most isolated island in the ocean. They vary in size from tiny one-inch squirmers in America and elsewhere to eight-foot monsters in Australia that make a startling slurp like a heavy

boot in mud as they move around under the surface.

Worms bury not only themselves but many of the most prized works of man. They build up earth around a monument or building, then cut burrows under the foundations to undermine it further. The worms' castings rise about the building at a very slow rate—an inch every ten years. But the combination of the worm-raised ground and the sinking of the foundation to the depth of the burrows can make any building sink out of sight when the process is repeated for generations.

When that worm does turn, then, it can make the walls of man's mightiest structures come tumbling down and prove the humble little crawler's right to its royal title: *King of the Underground*. •



Though it's nothing for a worm to sprout one new tail, this wriggler grew two at the same time.



Their Business Is Gilding Lilies

Mechanix Illustrated

May, 1951

Who says you can't improve on nature? This beauty salon for foliage proved the old adage wrong.

By S. Howe Coe

"DO you have anything a song and dance chorus can use for fans?" The woman's voice was hurried as Elmer Newbeck turned from arranging a wreath of red and white carnations. It was nearly closing time in the florist shop.

"I've just discovered all the girls' fans have disappeared from the club," said the excited woman. "I can get new ones tomorrow but I need something for tonight's show."

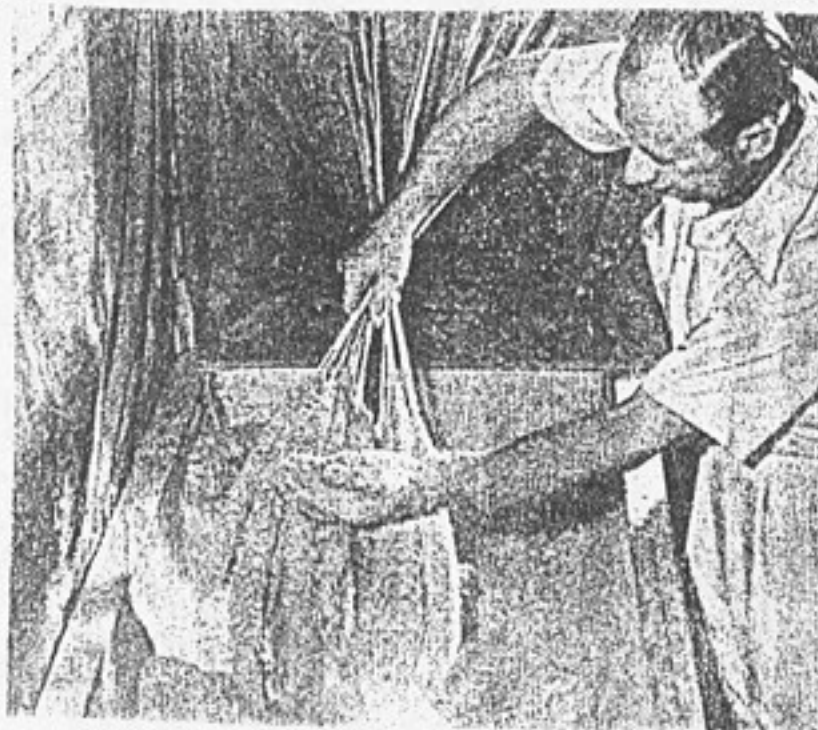
Elmer had worked in the florist shop for 20 years and there had been many requests for "something different" for decorative ideas, but this was the first time he'd been asked for something to take the place of fans in a song and dance routine.

"I don't believe . . ." he hesitated. Then, on second thought, "I don't think we have a thing here to use for fans but I've been flocking some ferns in my workshop that might do; if you can wait."

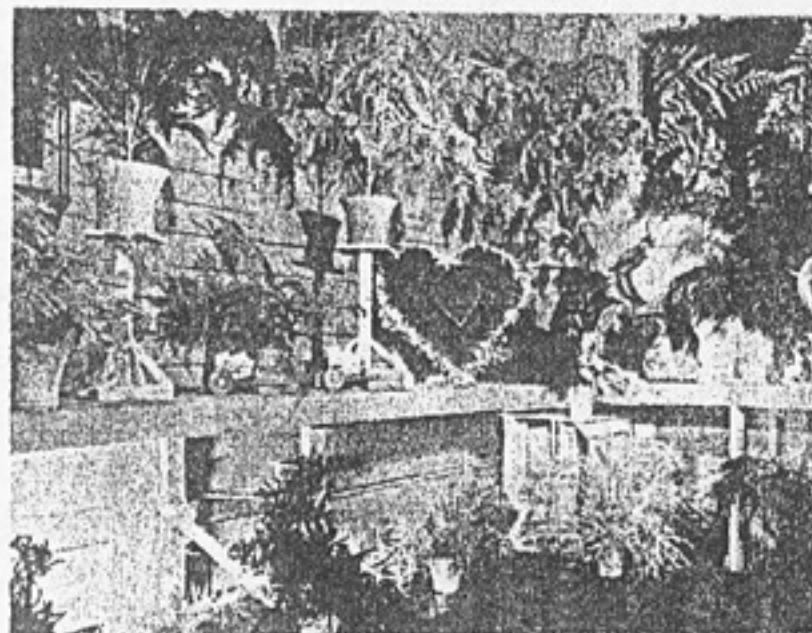
Elmer drove the worried young woman to his garage workroom and showed her some white and pastel-colored ferns he had coated. They were exotic and unusual but he hadn't thought of them as fans. However, the woman thought they would do for one evening. She bought dozens of them, selecting the broadest, most beautiful fern sprays, and hurried away.

That was Elmer's first sale of the flocked foliage over which he had dreamed and worked for many months. His company hasn't sold any foliage for the same purpose since, but it has sold thousands of them for a variety of other purposes.

You've probably seen some of them in your favorite shop windows. Perhaps a whole display was outlined with blue, pink or bright red



After adhesive dries, the foxtails are coated with flocking. Superfluous flock powder is shaken off.



Handsome than nature itself are these Nelen Company products which Elmer Newbeck dreamed up.



Elmer Newbeck, in foreground, on opposite page, sprays foxtails. Below, he spreads wet fern to dry.



Bunches of flocked palmettos are tied to ceiling to dry. Foliage in foreground is ready for shipment.

coated ferns. Or maybe you've attended a friend's wedding where the church or home was decorated with white foliage and fern trees made by the Nelen Company of Miami, Fla.

Elmer Newbeck's idea for utilizing wild foliage came during the many years he worked in the florist shop. Everytime a customer asked for something different for decorations, he thought about the simple beauty of the wild foliage that grows so profusely. Used in their natural state, they were as fragile and impermanent as the bouquets or flowers they always accompanied. So, he had toyed with the idea of trying to make them more lastingly beautiful.

Then one day someone gave him a spray of fern that had been coated. Part of the stem showed through the colored flock powder and had turned brown. Soon the ends of the spray curled and within a week its freshness had completely disappeared and several leaf sprays dried and dropped off.

"I think I can do better than that," he told his friend Charlie Glenn. Soon he began experimenting with his own ideas on flocking. His first purchases included shellac, varnish, liquid adhesive, a hand spray gun and several cartons of rayon flock powder. He talked with paint manufacturers, artists and friends and he read the little he could find on the subject of flocking. Then he drove out to several vacant lots to cut wild ferns, half a dozen kinds of grasses, palmetto blooms and some cattails.

The common Bracken fern was the subject of his first experiments. He placed several of these on a table, carefully spreading out the leafy stems. A spraying of colorless adhesive on both sides of the fern followed. It was pure accident, Elmer says, that he discovered that two coats of adhesive instead of one, gave the best finished results. That was when a couple of foxtails and palmetto branches fell into a can of adhesive liquid. They'd had one coat each of adhesive and flock powder, but they weren't all Elmer expected. When he gave the foliages that had fallen into the can a second coating of flock, the results were superior.

One of the first things he learned was that certain foliage responded best to processing when picked in early morning. This was particularly true of ferns—and a fern spray retained its fresh vibrant look for several months when processed the same morning it was cut. He also learned that if the variety of foliage was delicate, the adhesive should be sprayed on but if it was sturdy, like palmetto blooms and cattails, it was simpler and quicker to dip them in the adhesive.

As Elmer worked, his enthusiasm grew. He discovered that some foliage required two dustings of flock and that some grasses were doubly beautiful when given a spray of water

color paint over the flock. He made sea-grape leaves and the well known wood roses permanently beautiful with a 50-50 ratio of shellac and alcohol. He found that millet, wheat and pine branches could be transformed into breath-taking subjects for decoration when sprayed and dusted with pink, blue, green, white or silver and gold flock.

For unusual effects, he used colored adhesive and while it was tacky, dusted on a different color flock.

Charlie kept suggesting to Elmer that they go into business together and soon they became the Nelen Company (combination of the two men's names). Their initial cash outlay was \$500, which paid the rent on a small workroom, a supply of processing materials, lumber and wire netting to build work tables, and metal to construct a couple of bins in which to dust on the flock.

Bracken fern, sea oats, wheat, cattails, foxtails and palmetto blooms were flocked in bright colors and pastel shades for their first samples. The collection made a colorful showing in their station wagon as the men began their first trek to the doors of local florists, window-display firms, interior decorators and a few large department stores where window trimmers were employed.

"They're beautiful but what are they good for?" was the first comment. Tack the foliages all around a window frame to set off a display . . . use the fern plants to form a distinctive background in a shop window . . . arrange sea oats, sand, shells and fishing paraphernalia for a vacation display—these were a few suggestions the men made. They suggested mixing flocked ferns and foxtails with fresh flowers in bouquets, wreaths and large made-up sprays. A floral gift with flocked foliage in it will be doubly welcome to the recipient, they explained, because long after the blossoms are gone, the foliage remains a reminder of the gift.

Meantime, everyone who saw the Nelen foliage was interested in it, and business began trickling in. Samples were shipped to out-of-town florists listed in the American Telegraph Delivery Service catalogue and more orders resulted.

One thing the company doesn't have to worry about is a shortage of materials because there will always be an overabundant supply of foliage available simply for the picking.

Before long, a friend who was selling novelty goods between Miami and New York was selected as a one-man traveling sales force and suddenly they were swamped with orders. They hired and trained a couple of friends to build up a backlog of foliage. Then they found larger quarters where there were workrooms, office, display room and a separate building for storage.

The company is constantly looking for new and different kinds of foliage as well as new and better uses for their older types. All their spare moments are spent in doing research on the hundreds of profusely growing shrubs which might possibly become Nelen specialties. As to uses, they feel certain that eventually the florists themselves will dream up new ideas.

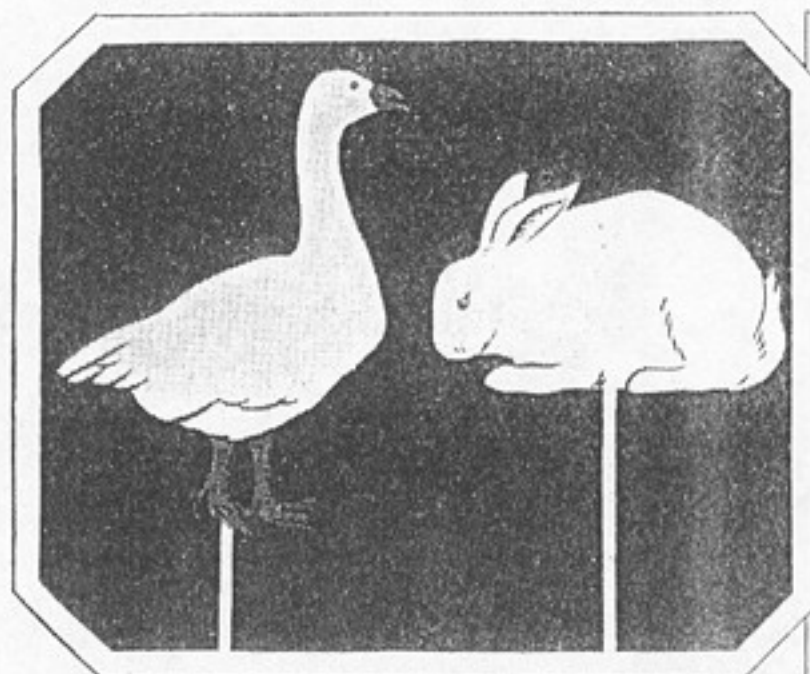
Not long ago, Leon M. Feffer, visited the Nelen Company to see the flocked foliage and before he left the shop he had talked Elmer

and Charlie into letting him buy into the business. Now, they believe that only the surface of the business' possibilities has been scratched. They point to a total of more than \$50,000 last year and confidentially expect to double it this year.

"Who says you can't improve on Mother Nature?" says Elmer Newbeck, the man who really gilds the lily. Not only did he give an assist to Mother Nature—but he gave Dame Fortune a helpful push as well. •

Mechanix Illustrated, 1934

WOODEN Figures Decorate Garden, Lawn



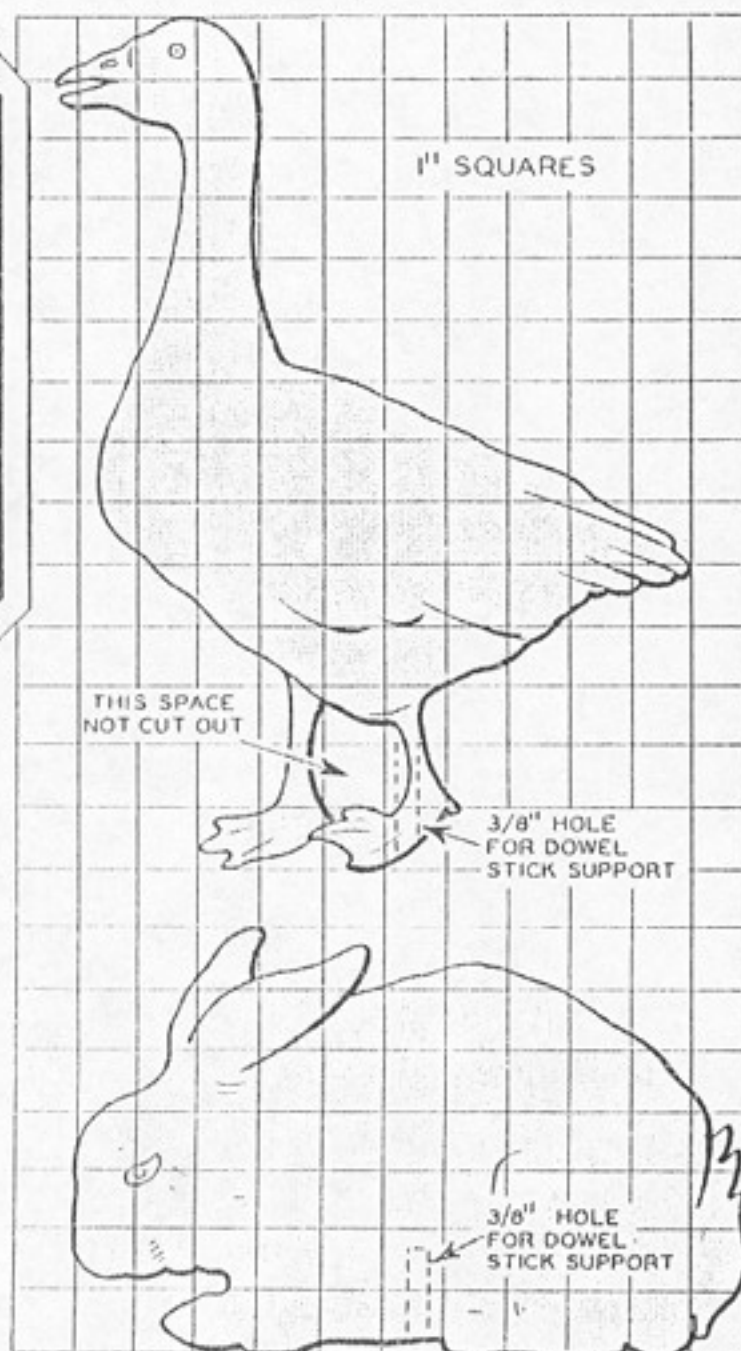
Here's how your garden ornaments will look when they're completed. Note how features are outlined in black lines.

YOUR garden, lawn, or flower bed will take on an improved appearance with the addition of a few of these little ornaments. They can be turned out in a few hours from old scrap lumber and they will give an unique air to your grounds.

The figures may be cut from whatever material you have available, but $\frac{3}{4}$ in. white pine is preferable. The squared chart at the right will furnish you with a guide for shaping either a duck or a rabbit.

The figures rest on $\frac{3}{4}$ in. dowels, which are inserted in the bottom of the figures at the points illustrated. These dowels are driven down in the earth to hold the figure steady.

As for the painting job, do the bodies in white and outline the limbs, feathers, eyes, bills, etc., in black. A touch of green will also help.



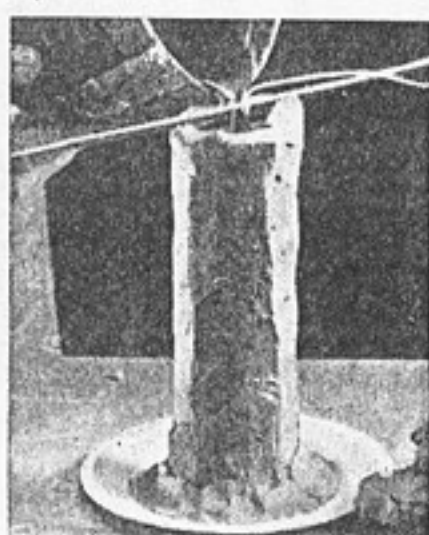
Cut out the ornamental figures according to dimensions shown on this squared chart. The $\frac{3}{4}$ in. dowel which fits up into the holes in bottom should be glued for firmness.



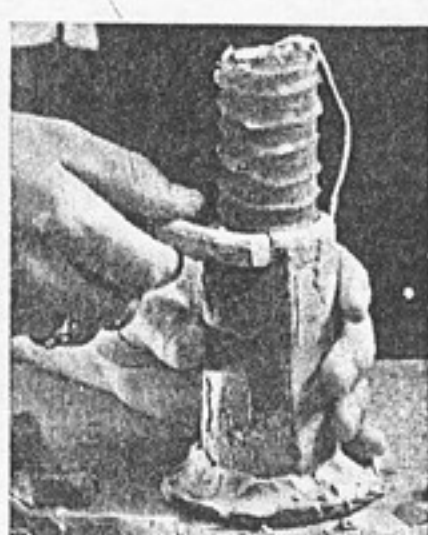
Coil 10 to 12-inch-long clay rope around towel tube; join ends of the ropes by pressing



Smooth coils with knife to seal cracks. Then remove tube, invert plate, thread wick through



Wrap wick around dowel, rest on top of mold. Pour wax, let sit 15 minutes or so, then refill



Cool wax until candle is firm; peel off clay. If clay clings, scrub with water and a brush

SUNSET NOVEMBER, 1957

First you make a mold...then cast a candle

These candles cast in clay have an unusual shape and an antiqued look.

To make them, you'll need a fine water-base ceramic clay, a paper plate, candle wicks, a paper towel tube, dye pellets, and wax. A half-and-half mixture of hard and soft candle wax produces the best-burning candle. You'll also need a coffee can and an old saucepan to make a double boiler in which to melt the wax.

Poke a hole in the middle of the paper plate and center the paper towel tube upright over the hole. Coil $\frac{3}{8}$ -inch-thick clay ropes around the tube, turning the tube about every two coils to make sure it's loose; then reinforce the base.

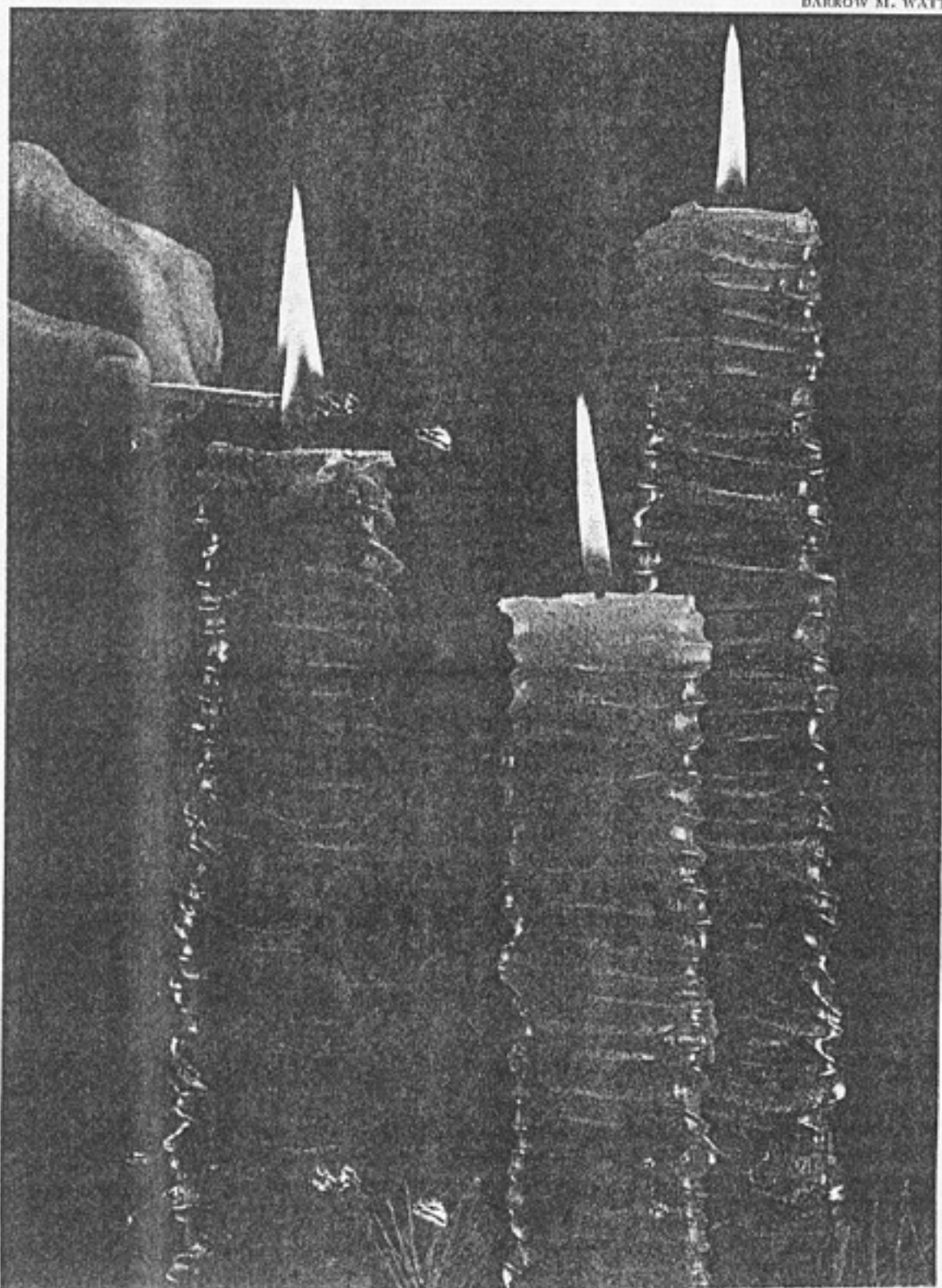
When the mold is completed, remove the tube and carefully invert plate and mold. Tie a knot in one end of a wick (twice the desired length of your candle); thread the other end through the hole in the plate. Pull the wick through the mold until the knot is up tight against the plate; wrap the loose end around a dowel or pencil and rest it across the mold.

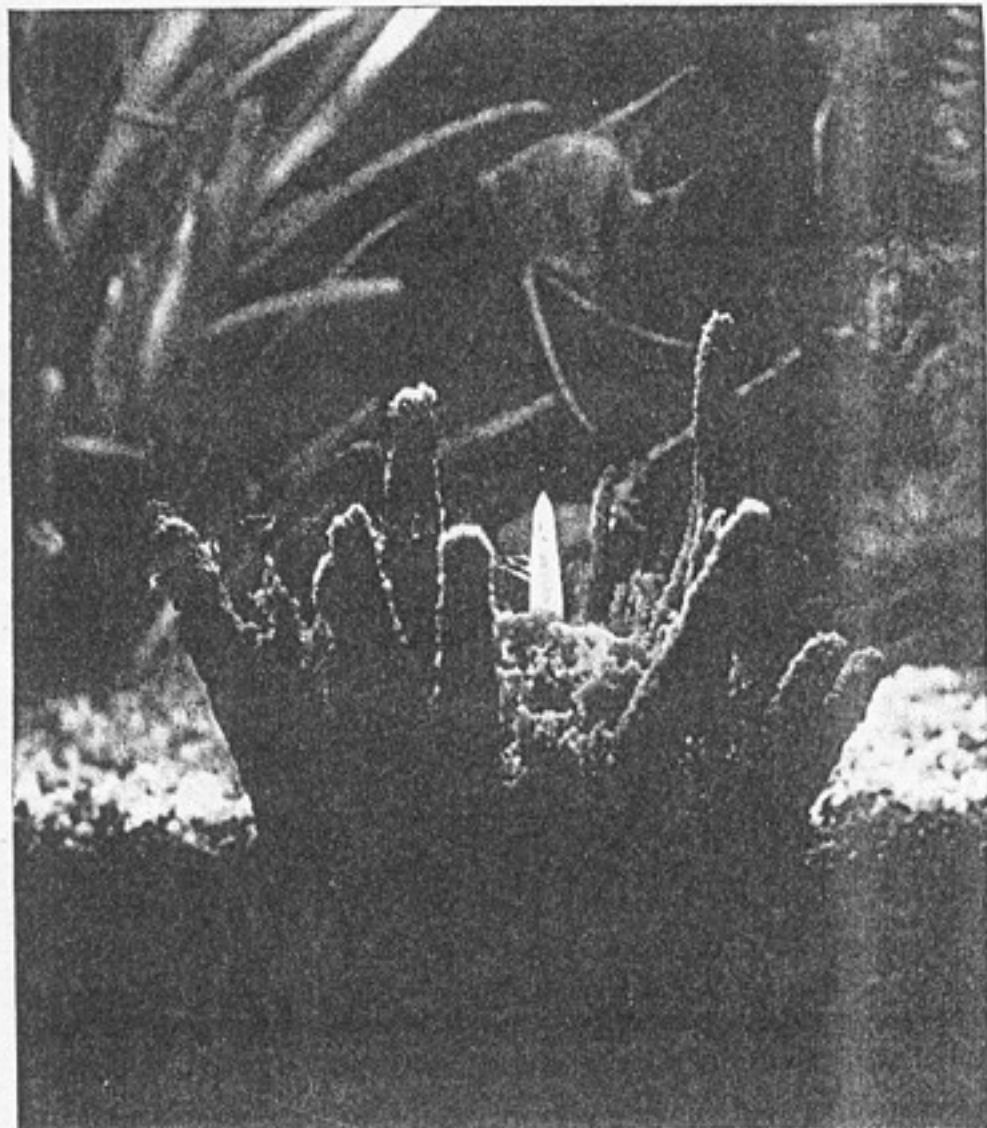
While pouring the wax, have some soft clay ready to plug any leaks that develop. As the wax cools, it may shrink away from the wick. If it does, add more wax. To speed the cooling, put the mold in the refrigerator for about half an hour.

When the candle is cool and hard, remove the mold and all traces of clay.

Clay-cast candles have attractive antiqued look. Wax conforms to smallest indents

DARROW M. WATT





Sand-cast candle, being eyed by aquarium fish, resembles coral formation

SUNSET
NOVEMBER 1969

Candles from a sand mold

This candle, which looks like a piece of coral, was made by pouring wax into a mold formed in damp sand.

Grains of sand embedded themselves in the wax to give the candle its rough, unusual texture. The mold was shaped with

a glass jar and the handle of a paintbrush. You can make many different forms with tools and utensils you'll find around the house.

A plastic paint bucket from a paint store is a good container for the sand—the



1. *Make candle mold in bucket filled with damp sand. Press glass jar into sand, then with end of paintbrush poke deep holes in sides*



2. *Use old candle stub to supply wick, pushing it down into center of mold. Spoon melted wax into depressions, being careful of mold*

right size and easy to work in. The sand should be fine enough to hold its shape; fairly fine beach sand or sandbox sand works well.

DARROW M. WATT



3. *With depressions partially filled, spoon crushed ice on top of wax. Interaction between ice and wax produces interesting bubbly effect*



4. *Once paintbrush holes are filled, pour enough melted wax to fill large depression level with top of sand. Let wax cool until it is firm*



5. *Remove candle. Brush it gently to remove excess sand, then rinse it under water. The color of the wax comes through the embedded sand*



At top (l. to r.): elephant with cardboard appendages; sailor with spray-can lid hat; rick-rack trimmed Indian; sheep with toothpick legs; feather-crested bird. Center: fish with scales of imitation mother of pearl; paper-fringed lion; girl with raffia hair; lady with yarn hair; mouse with brush-bristle whiskers. Bottom: kabuki dancer; yarn-topped gooney bird; lady with cloth sunbonnet; Mad Hatter, felt hat; cotton-trimmed rabbit

Each of these blown Easter eggs has acquired a different personality; many designs are suggested by the basic shape of the egg

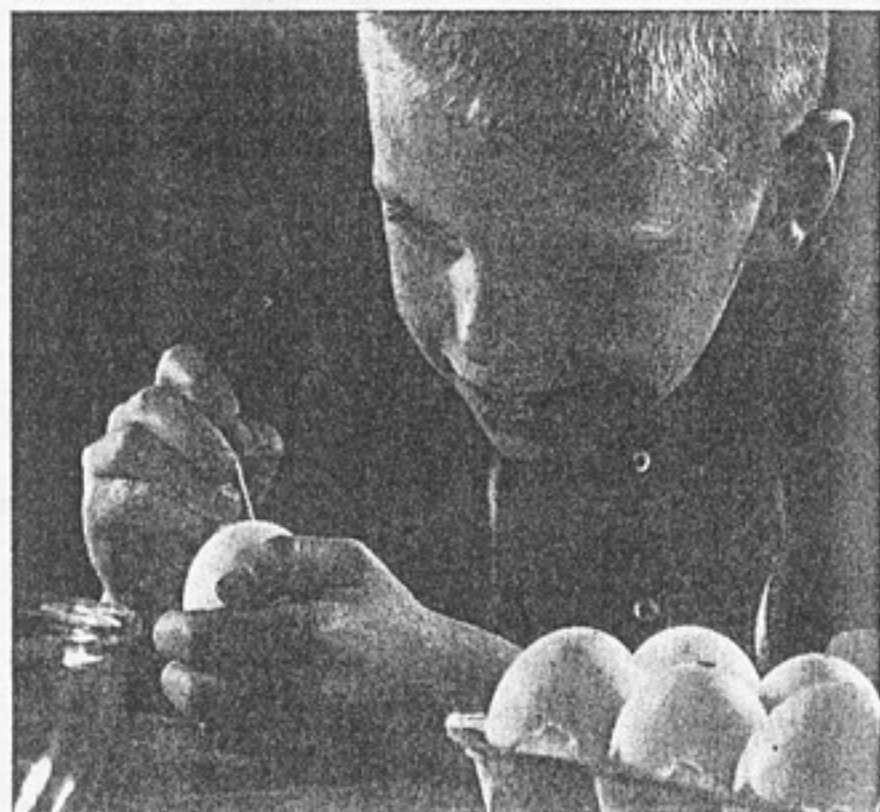
SUNSET APRIL 1965

How to make an egghead or an egg menagerie

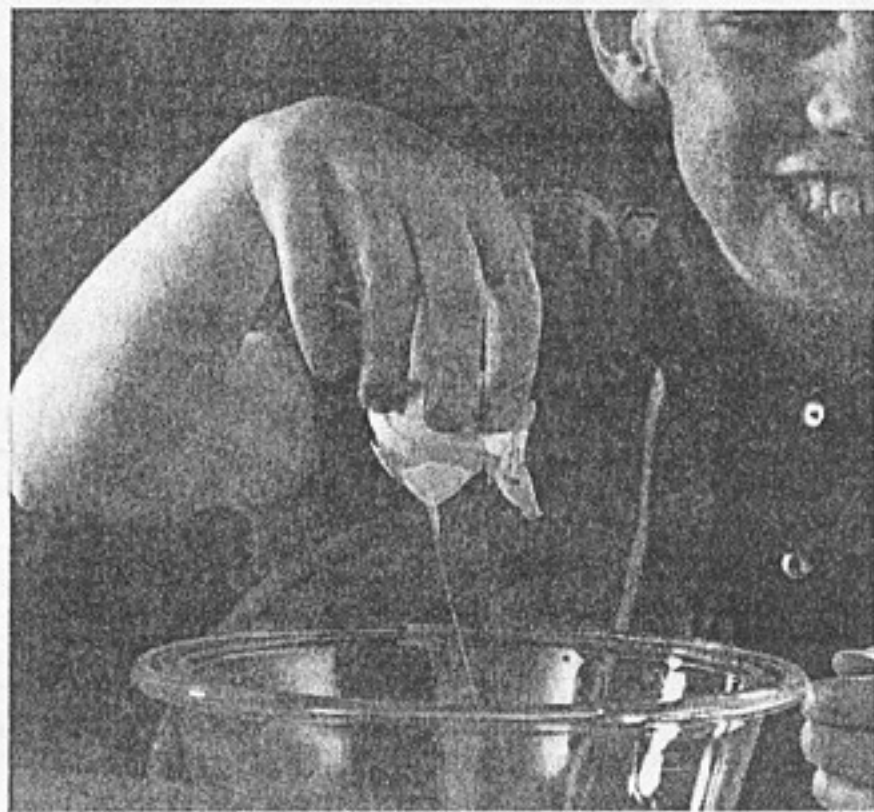
We picture 15 designs of animals and heads above. You can easily think of many others. Abstract designs using circles and stripes are perhaps easiest.

From the endless variety of decorating materials, we selected thin cardboard, white glue, felt, yarn, and spray cans of enamel. All are widely available.

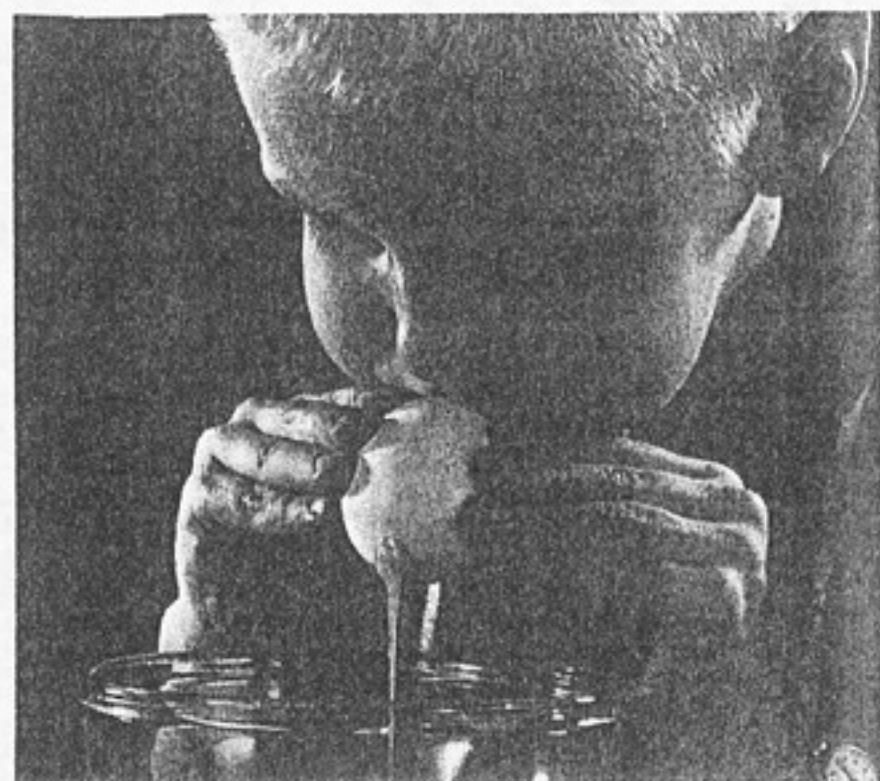
You will find that the effect of the egg shape depends in part on whether you place the egg on the large end, on the small end, or sideways. (Compare the rabbit and sheep above with any of the people-faces.) You can make an egg stand up by gluing on cardboard legs or a collar, or making small holes and inserting toothpick legs. A fine felt-tip pen is good for drawing faces.



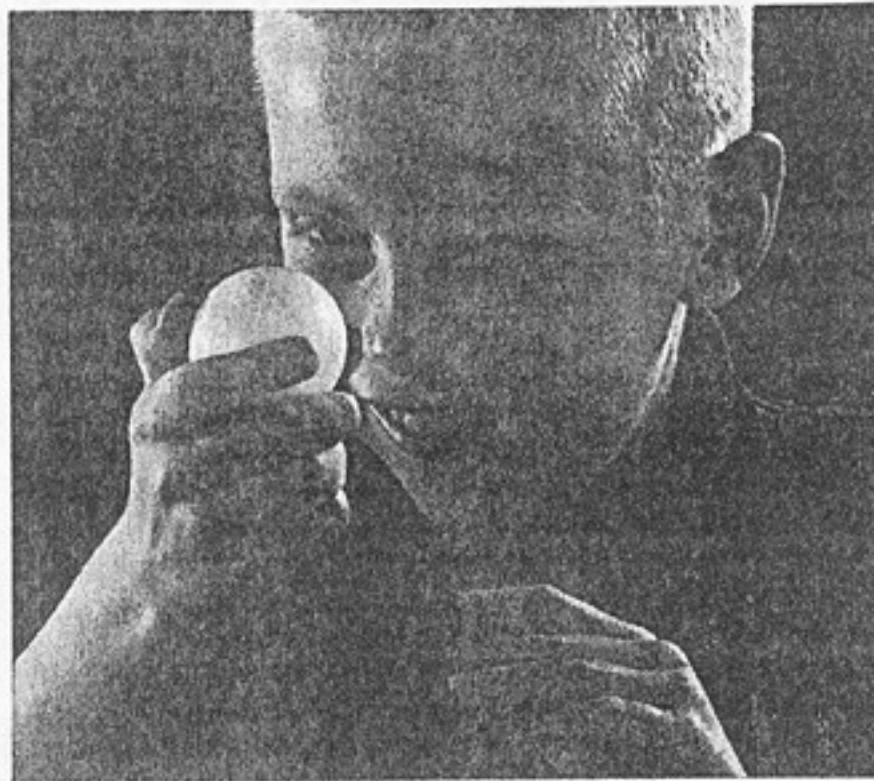
Make a small hole with a darning needle at one end of the egg, a slightly larger hole at the other end. The egg will empty more easily if you puncture the yolk several times with the needle



Whoops! This may happen if you use a blunt needle, or hold the egg too tightly. The broken egg (with the bits of shell carefully removed) can still be used in omelets, or in baking



Blow gently through the smaller hole, holding the egg over a bowl. Large holes make the egg easier to empty; however, when you decorate you will probably want the smallest holes possible



Peeking inside the egg is a good way to see whether you have blown it clean. After rinsing the empty shells inside and out, stand them on end to dry. They are then ready to be decorated

SUNSET April, 1965

How to blow an egg

With practice it's really easy

If your Easter egg designs turn out better than expected, you may regret having made your masterpiece on a raw or hard cooked egg. Either is essentially perishable.

The answer, of course, is to use the ancient art of egg blowing. That way you end up with raw-scrambled but usable eggs, and fragile but non-perishable shells. Save the leftover mixed whites and yolks for cooking; they are good for scrambling, for various baked dishes, or for any recipes requiring large numbers of whole eggs.

The art of blowing eggs is explained above. You may be surprised at how easy it is to learn.

After blowing several eggs, you're ready to start decorating.

SUNSET
MARCH 1970

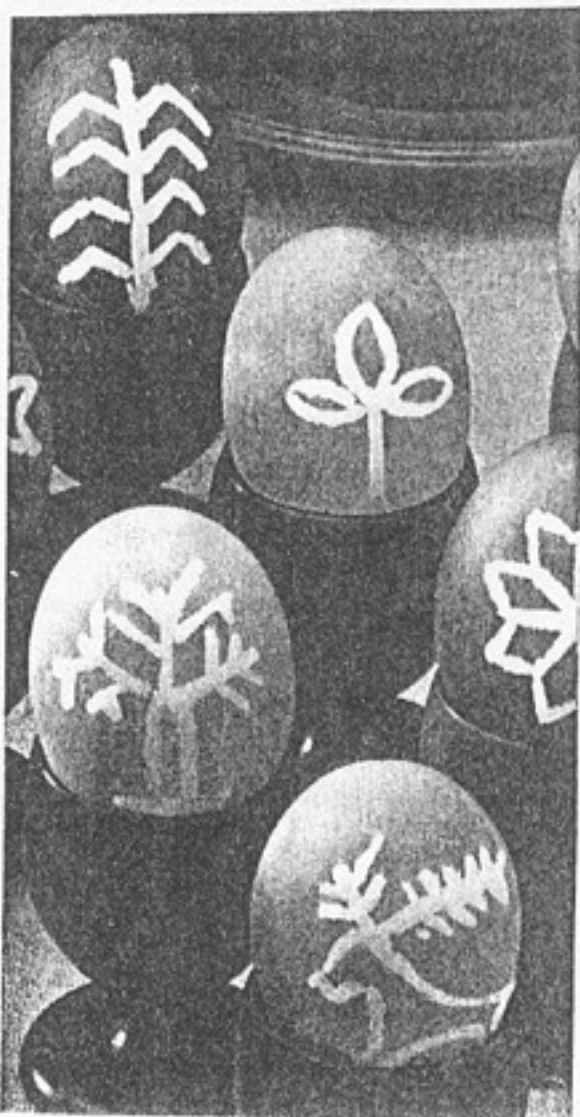
You write on the egg with wax... then you dye it



Ukrainian eggs with intricate designs inspired simple ones shown below

Pysanka, the name for decorated Ukrainian eggs, comes from a word meaning "to write"—and that's how you make these Easter eggs. You write with wax on the egg and then dye it.

In the Ukraine, the decorating of Easter eggs is an art that has been passed down from one generation to another for more than a thousand years. The eggs are min-



Traditional symbols: Pine tree (at top) and rough-barked tree come directly from nature; the flower represents happiness; reindeer means prosperity

iature masterpieces with layers of colors applied in exact designs. The traditional egg shown in the photo above was created by Mrs. Jack Austin of Bellevue, Washington. For ours, we simplified the traditional motifs.

The principle is similar to that of batik: Melted wax applied to various spaces protects them from the dyes. By waxing and dyeing several times, one can apply many different colors and designs to the egg.

To make these eggs, you need cold dyes, wax, and fine paint brushes or styluses. If hard-cooking the eggs, be sure to use U.S.-certified colors so they will be safe to eat. If making the eggs strictly for decoration, blow them first, then dip them in richly colored, non-edible dye made from a thick strip of crepe paper, a little water, and a tablespoon of vinegar (or use the softer-toned certified colors).

Use clean, white eggs at room temperature. If you must wash the eggs, do so in plain water and dry in a slightly warm oven. If the natural oils are removed from the egg, the dye won't sink in evenly. Hands, too, must be clean. Hold the egg in paper towel while working to keep it free from oils.

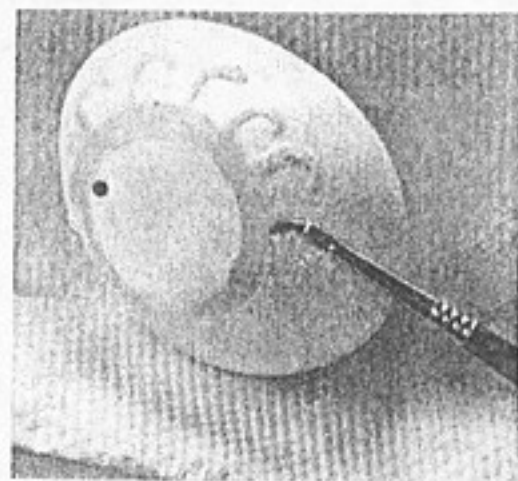
The wax should be hot; melt it in a double boiler over medium heat. With a brush, apply wax to warm eggs (wax dries too quickly on cold eggs and doesn't flow evenly). You might want to try some of the typical Ukrainian designs shown here—or work out simple or complex patterns of your own. It takes practice to draw straight lines with wax.

When dyeing with several colors, start with the lightest color and gradually work toward darker areas.

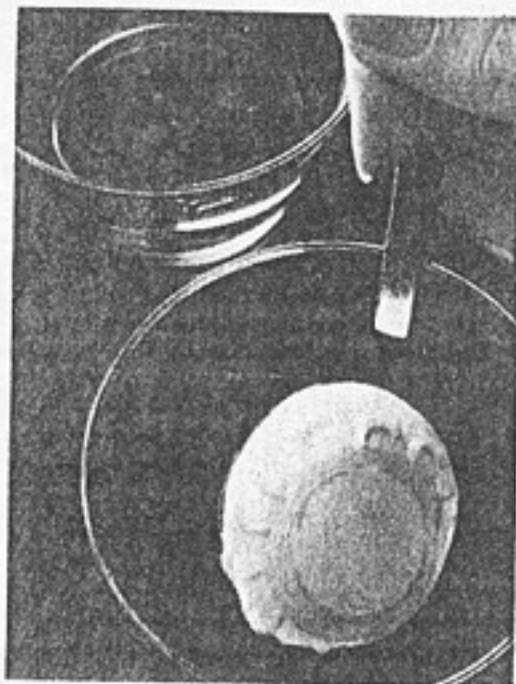
Remember to rinse the eggs in cool water after each dye bath and dry them between rinsing and rewaxing.

Remove the wax with a cleaning solvent (such as denatured alcohol) after completing dyeing steps. The solvent gives the eggs a slight gloss. If the egg is beautiful enough to be a keepsake, it deserves

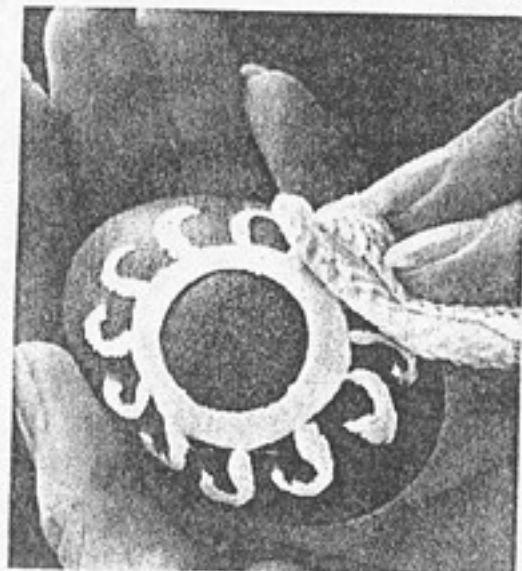
a permanent glaze: Apply shellac thinned with alcohol with a lint-free cloth. Rub the solution over the egg quickly and gently; set aside to dry.



Draw directly on warm egg with hot wax; work with egg wrapped in a towel. The sun motif symbolizes life



Dip egg in dye bath starting with lightest color if you plan to have several colors; repeat waxing and dyeing



Carefully clean wax from finished egg with solvent; this will give it slight gloss (shellac needed for high shine)

SUNSET
APRIL 1972



With a mighty pounce Mark crushes an eggshell

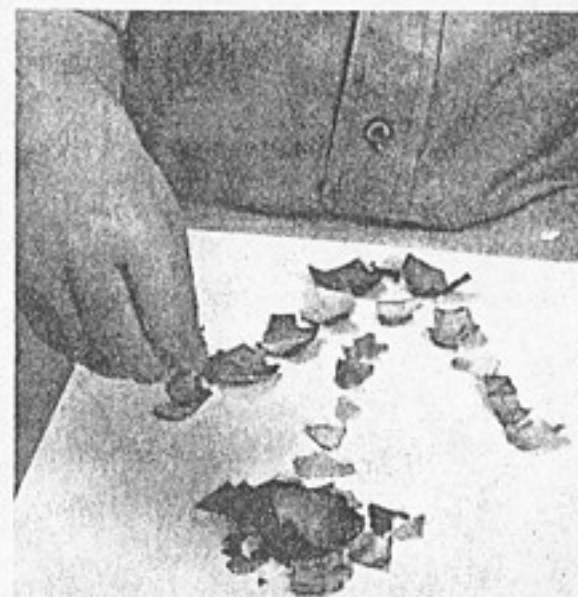
Smashing eggshells and using the chips to make mosaics

Some quiet day when your youngsters are in the mood for a lively little craft project, have them try eggshell mosaics. Here the fun of the doing is really more important than the results.

An interest in eggshell mosaics starts when the 3-year-old is able to crush and glue, and it continues right up to adult levels, when the intricacy of mosaic fitting keeps the imagination stimulated. All you need is a supply of rinsed eggshells, two or three colors of crepe paper, white glue, and some kind of backing paper. Construction paper is fine for experimenting, but for a lasting mosaic use a heavier paper or cardboard. We suggest using crepe paper for the



A finished piece by an 8-year-old



Young artist carefully arranges large shell fragments to make a flower design

dyes for its particularly brilliant hues.

To prepare for dyeing, fill several bowls or cups with hot water (choose glass, enamel, or stainless steel containers that won't stain). Add a teaspoon of vinegar for each cup of liquid. Cut a length of crepe paper and add to the water; continue to add crepe paper until you have the color intensity you want.

Stir several eggshells around in the dye. Use rubber gloves, if you wish, as the dye will stain fingers (if you don't like wearing gloves, normal washing will remove the stains within a day). Keep the shells in the dye until they reach a pleasing shade; the longer they soak the stronger the color will be.

Remove the shells from the bowls and place on a broiler tray or cookie sheet (lined with paper towels to absorb extra water). Bake for at least 30 minutes at 300° or until the eggshells are dry and crisp. Assemble the background paper, white glue, and eggshells.

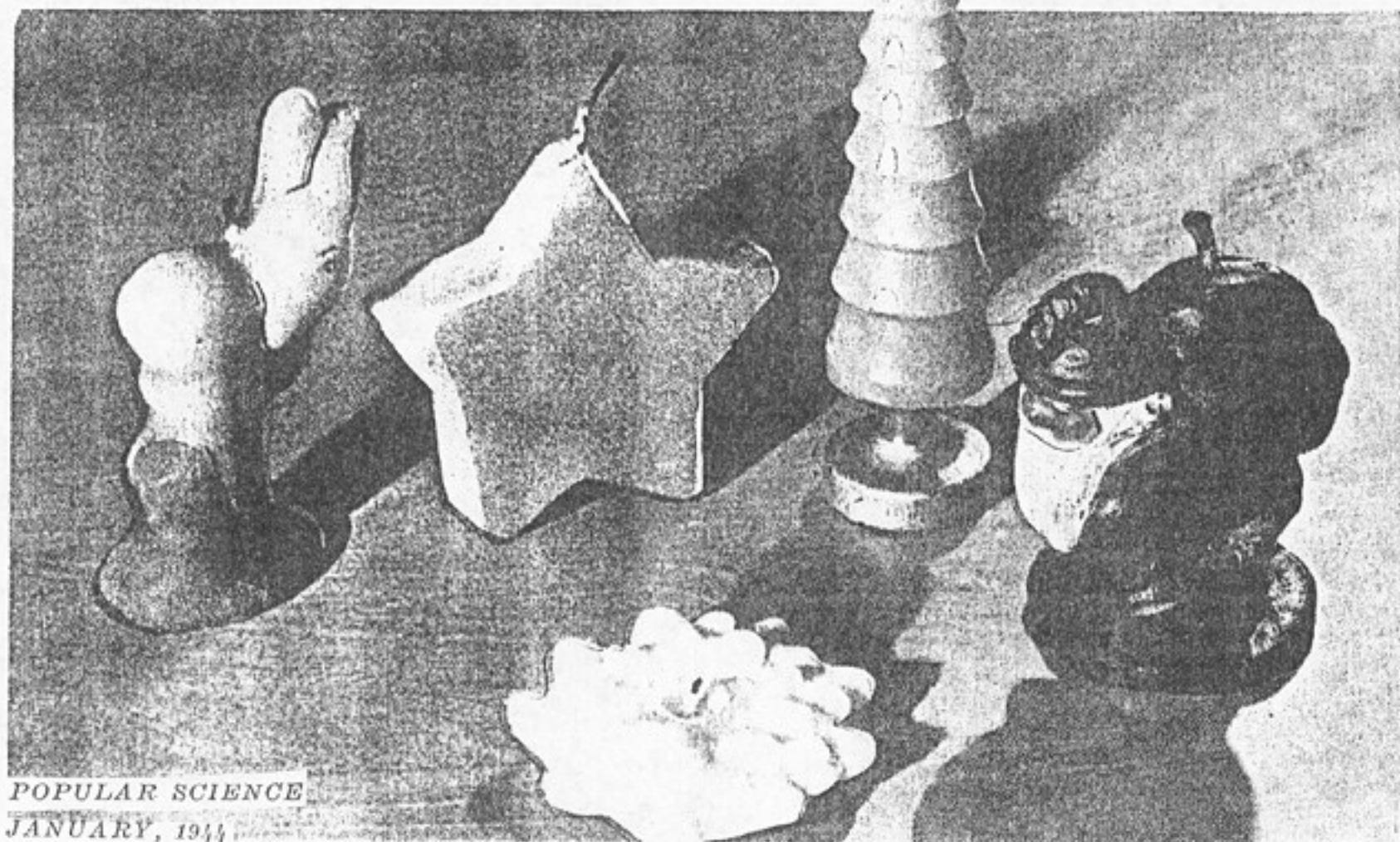
Now comes the part that's fun. Turn each eggshell so that the round end is up and use the palm of the hand to squash it. Or, if you want tiny pieces, use a rolling pin as a smasher.

Some children will want to design as they go along. Others will prefer to sketch out a design in advance using a crayon the same color as the background. If you have several children working at once you'll probably find they create a variety of abstract and recognizable patterns.

A technique that works well with very small children is for you to sketch out the design with glue first. Then have the youngsters mash the eggshells into fine pieces with a rolling pin, sprinkle them on the paper or cardboard, and shake it. The shells will stick to the design lines. □

ORNAMENTS SERVE AS MODELS FOR

Novel



POPULAR SCIENCE
JANUARY, 1944

By ELMA WALTNER

CANDLES are so traditionally a part of the holiday season that even in their plainest form they rival holly and mistletoe as symbols of Christmastide. Gay candles like those above, however, will lend an added air of festivity to any surroundings, and they can easily be made at home in many different and fanciful shapes.

You will need some inexpensive glass or china figures such as are stocked on the knickknack shelves of variety stores. By using these figures as patterns, you can cast various different candle molds. Any type of figure will do so long as it is nonporous and has neither undercut surfaces nor frail parts extending too far out from the main mass. The molds are made by pouring ordinary plaster of Paris around the patterns.

With a figure at hand, obtain a light cardboard box that will accommodate it with at least $\frac{1}{2}$ " to spare all around. Work a small lump of modeling clay into the shape of a cork and stick it against the bottom of the figure as shown in the drawings. Oil the figure evenly with light machine or olive oil. Mix a supply of plaster to a creamy consistency. With one hand, hold

the figure about $\frac{1}{2}$ " above the bottom of the box; then add plaster until the model is half immersed in it. Keep holding the figure for a few moments until the plaster is stiff enough to keep it from sinking. In 15 minutes, use a knife, drill, or countersink to form the two keys which will later aid in locating the other half mold properly.

Now thoroughly oil the top surface of the half mold to permit separating of the two parts easily after the top half has hardened; then completely cover the figure with more plaster. Allow another 15 minutes for this new "pour" to set. Peel away the paper box and use the blade of a knife to pry the mold apart. It will separate easily.

Melt the wax of some inexpensive colored candles and remove the wicks. Heat the wax over hot water rather than directly over a flame, for overly hot wax will create bubbles in the finished candle. At the top of one of the halves of the mold, cut a little groove through which the wick may extend. Then lay in the wick from the top of the mold to the bottom, where it should be long enough to extend through the pouring hole formed in the plaster as it hardened around the lump of clay. Join the two halves of the mold and bind them securely together with

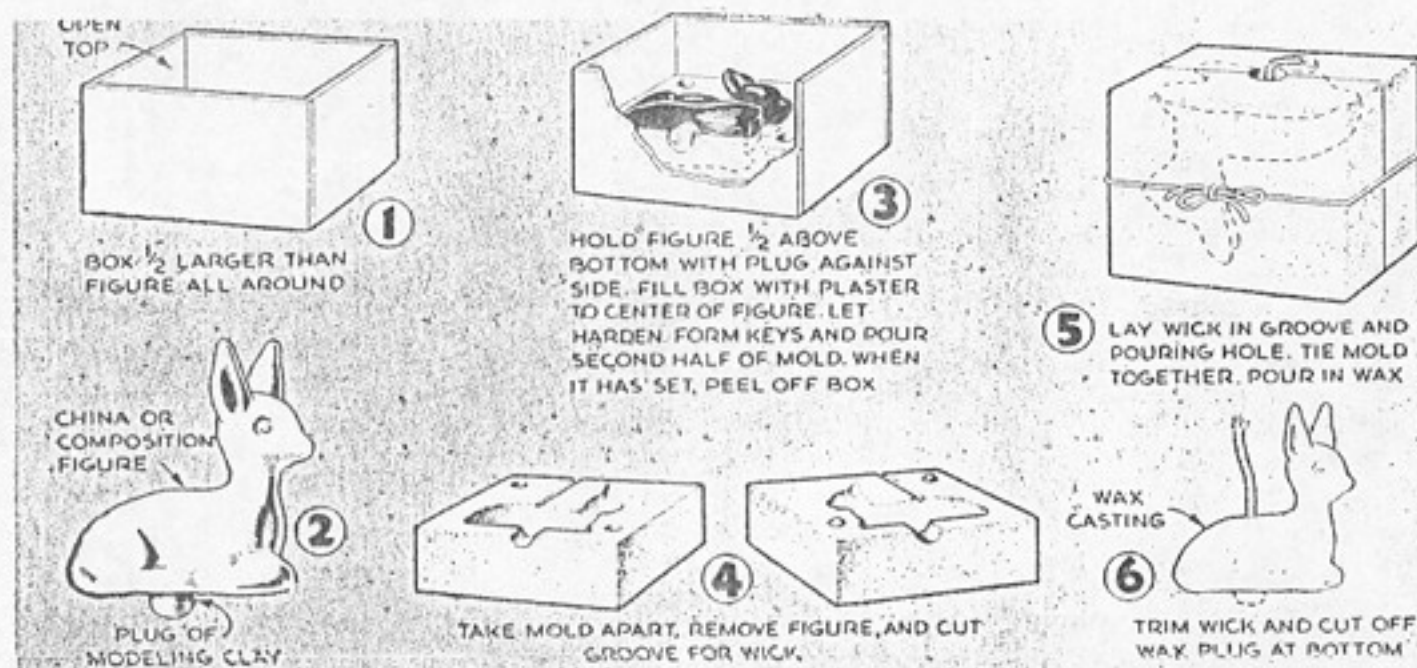
Holiday Candles

stout cord. Turn the mold upside down and pour in the melted wax, which should first be allowed to cool to a point where it will harden immediately upon contact.

The wax will shrink a little as it cools in the mold, and you may need to add a little after the first complete filling. Allow the wax to set, but not to become completely

cold. Then untie the mold and remove the candle. If the first candle has a tendency to stick, grease the inside of the mold before pouring the next one.

Figures modeled in clay, as well as glass and china figures, can be used as patterns for candle molds. Amateur modelers can produce many appealing original pieces.



Star-Shaped Santa and Pine-Cone Bird Help Decorate Tree

SANTA CLAUS, in the genial guise of a Christmas-tree ornament, appears in the photograph below in a really stellar role. A number of these fat little star figures, dangling from the boughs of a yuletide evergreen, will be more distinctive than most machine-made tree baubles; and they can be turned out in jigtime with little more than a pair of scissors and a few household materials. Cut the star from a piece of red construction paper and paste a small strip of white paper on part of one point to serve as the face. Ink in the eyes and nose; then add the fur trim, buttons, belt, and the old gentleman's whiskers, using wisps of cotton attached with glue. Slip a wire or loop of colored string through the tip of the uppermost point of the star.

The cocky little bird of paradise at the right will also grace a festooned spruce or hemlock. Shape the head from a small pine block and attach it to the pine-cone body with a dowel glued into holes drilled in each part. For plumage, use either real feathers or swirls of bright-colored paper glued to the cone. Suspend the bird from a ring of wire covered with crepe paper. A painted wooden ring, if you have one handy, will serve as well for a perch.



POPULAR MECHANICS April, 1951

Cut-Down Card Table Provides Stand for Portable Indoor Sandbox



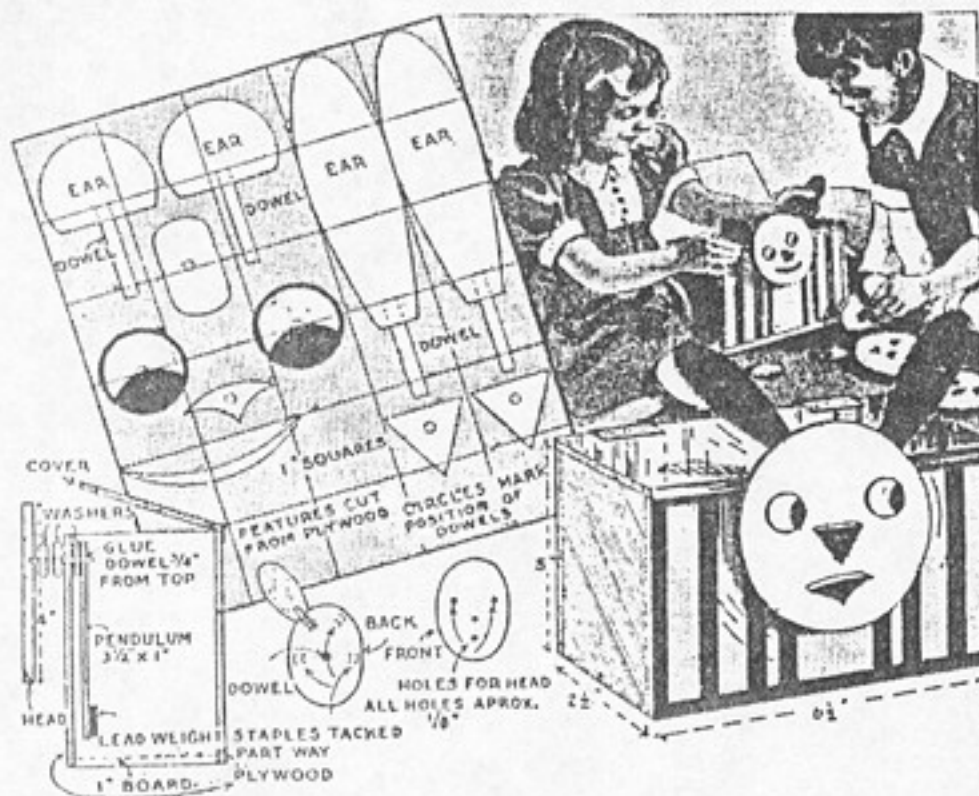
Rainy days won't spoil the youngsters' fun if this indoor sandbox is set up in the basement or playroom. An old card table serves as a stand for the sandbox and, when the sand is poured into a bag, the unit can be folded for compact storage. The legs of the table are cut off about 5 in. from the ends to lower the box to a convenient height for the children. A simple box, or tray, is made by nailing four lengths of 1 x 6 to a 30-in.-square bottom of plywood or hardboard. The bottom of the box is then screwed to the card-table top, all wooden surfaces are sanded smooth and the entire unit is given a coat of bright-colored enamel. When the enamel has dried, the surface is sanded lightly and covered with a coat of clear lacquer. Colorful decals can be applied to the sides if desired. The box is filled with clean sand to about 2 in. from the top. Of course, there is going to be a certain amount of sand spilled on the floor. However, this can be minimized by nailing strips of lattice stock along the top edges of the box sides so they overhang the side members toward the center of the box.

Victor H. Lamoy, Upper Jay, N. Y.

POPULAR MECHANICS AUGUST, 1940

Amusing Animal Toy Can Change Its Face

Wagged from side to side by a pendulum, the head of this toy has interchangeable eyes, mouth, nose and ears, which can be used in various combinations to produce unusual facial expressions. Variations of these facial parts are shown in the squared detail. All parts have dowels attached for anchoring them in place, and they all fit in holes in the face except the ears, which slip into staples on the back of the head. The base for the head is a box with the front side painted to resemble the bars of a cage. As shown in the lower left-hand detail, the head is attached off center to a dowel, which turns in a hole through the side of the box. Washers are used as spacers between the head, box and pendulum, which is fastened rigidly to the end of the dowel



inside the box. The box is painted yellow, bars black and the face white with black features.—R. L. Fairall, Los Angeles, Calif.

TUMBLE

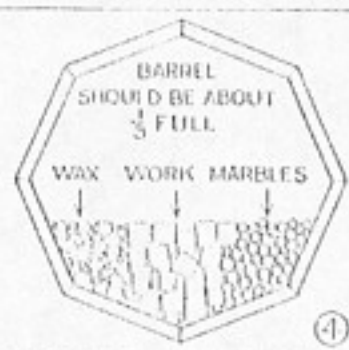
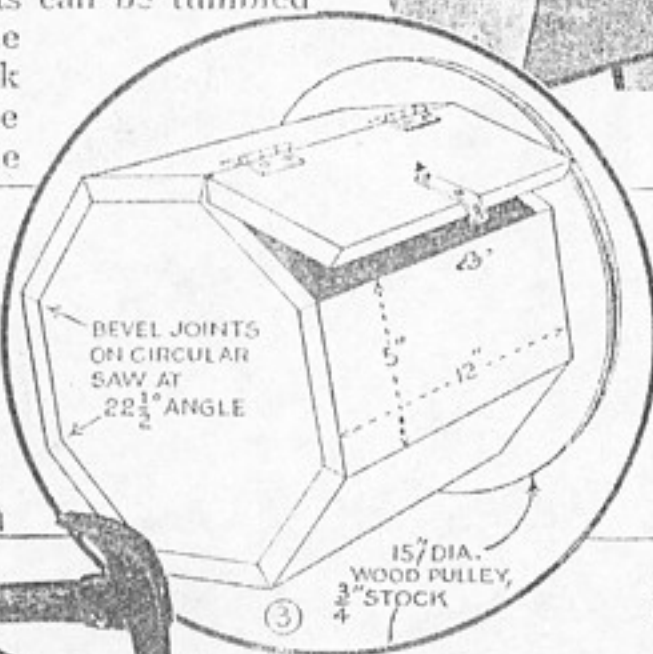
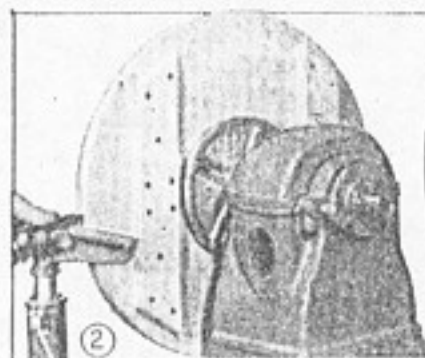
for a Perfect Finish

EXTENSIVELY used in industry for finishing small parts of wood, metal and plastic, the tumbling barrel, Fig. 1, affords an excellent method of finishing in home shop work. A beautiful surface of velvety smoothness can be obtained in this manner—a finish practically impossible to duplicate by any other method.

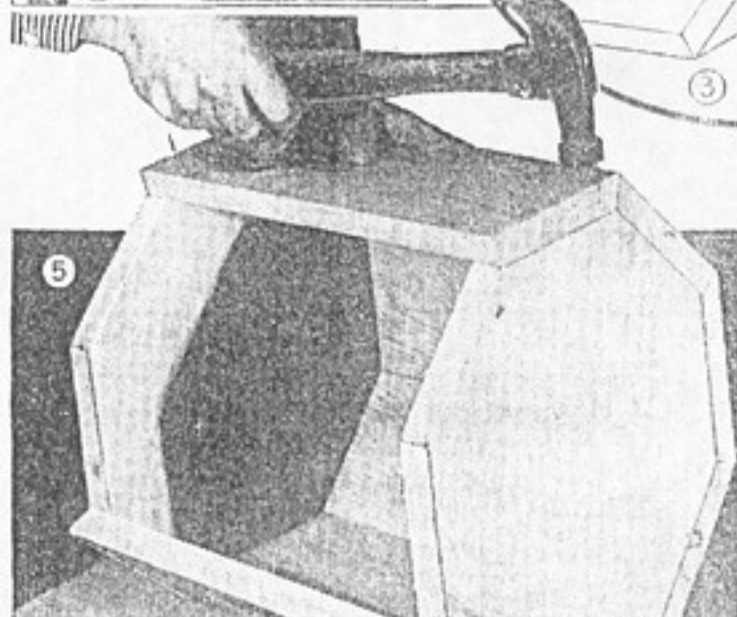
Even fairly large parts can be tumbled to produce a super-fine finish, the size of the stock being limited only by the size of the barrel. The one



Wood, metal or plastics can be given beautiful finishes



Above, suitable mix for wax tumbling wooden parts, using paraffin

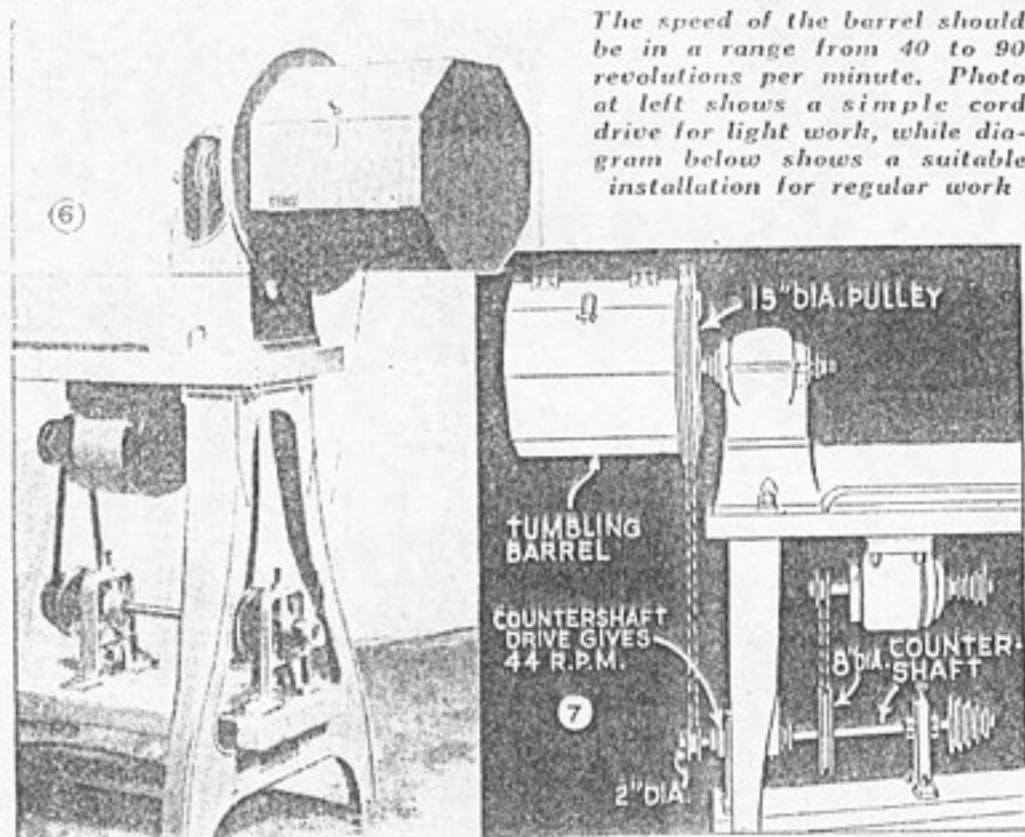


shown here is dimensioned for very small parts of wood or plastic. It would hardly serve for any appreciable number of metal parts due to the small size and the overhang. However, you can enlarge on the same idea by using a metal drum with a bearing at both ends. A simple spur gear can be used to give the necessary reduc-

tion in speed. Of course, more power will be required to drive the larger-sized drum or barrel, even though the speed is greatly reduced through a spur-gear arrangement. Also it is necessary that the drum be balanced closely to prevent power loss.

The first requirement is the barrel, Fig. 3. Stock used in the construction should be hard maple. The assembly is first made by nailing the pieces together, as shown in Fig. 5, after which the joints should be permanently fastened with screws. One section is hinged to form a lid. Then the barrel is fastened to a pulley turned from hardwood as in Figs. 2 and 3. This completes the tumbling unit.

Plastics, wood or metal objects can be tumbled successfully, but slightly different methods must be used in each case. For wood parts, the work should first be sanded smooth and colored with stain.



The speed of the barrel should be in a range from 40 to 90 revolutions per minute. Photo at left shows a simple cord drive for light work, while diagram below shows a suitable installation for regular work

Then, into the barrel, together with a quantity of paraffin cubes and steel balls or glass marbles, the proportions being about as shown in Fig. 4. The paraffin finish can be applied in about $1\frac{1}{2}$ hours; harder waxes such as carnauba and beeswax require a longer period of tumbling. If the resulting coat of wax should be too heavy, decrease the amount of wax cubes and increase the amount of work and marbles. A further luster can be given waxed work by tumbling the pieces with small squares of cloth.

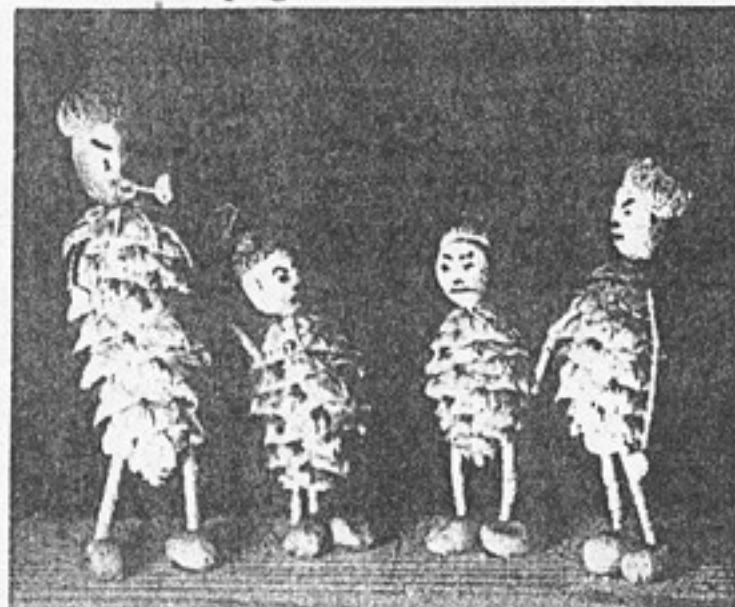
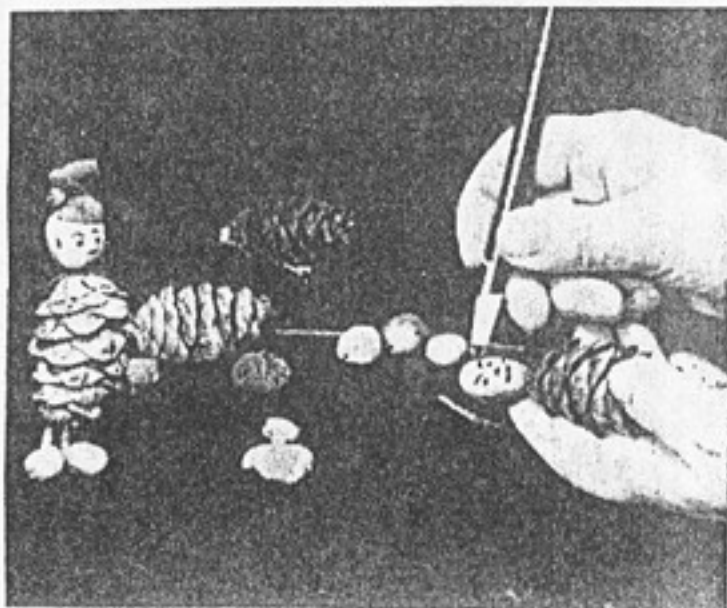
The speed of the barrel is most important. It is essential that this be kept below 90 r.p.m. At slightly higher speeds the work will bounce, with the result that the finish will be pitted; at about 150 r.p.m. the work will not tumble at all, but will simply cling to one side of the barrel through centrifugal force. For light loads, a suitable speed can be obtained by using a belt made from stout cord, running this directly over the $\frac{3}{4}$ -in. lathe countershaft, Fig. 6. Slight slippage will result in a speed of about 60 r.p.m. For regular work, the drive shown in Fig. 7 is suitable.

AMUSING DOLL-LIKE FIGURES ARE FASHIONED FROM PINE CONES

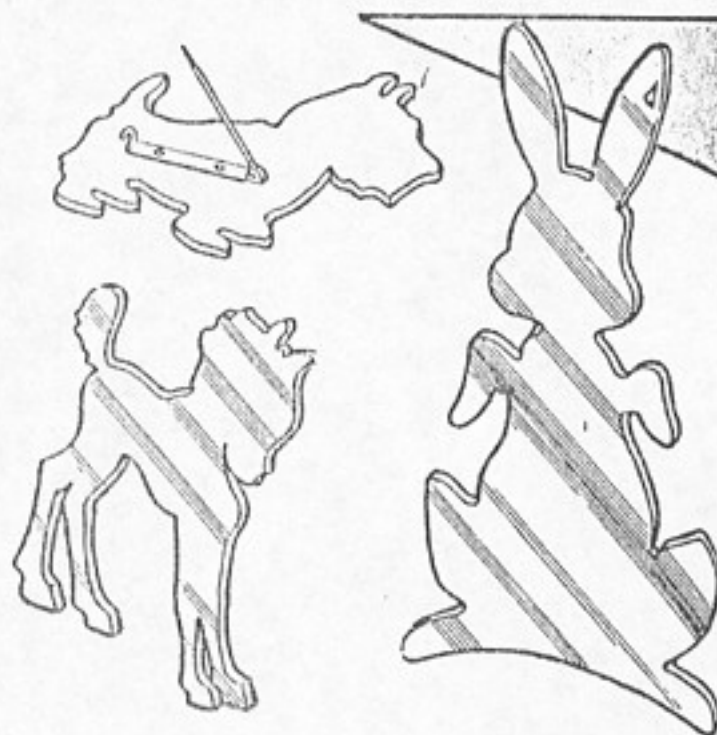
NOVEL comic characters for entertaining children, adding to a knickknack shelf, or furnishing a table-top photographer with subjects can be made from odds and ends found in the average garden.

Pine cones serve as the bodies, acorns become heads when the features are marked

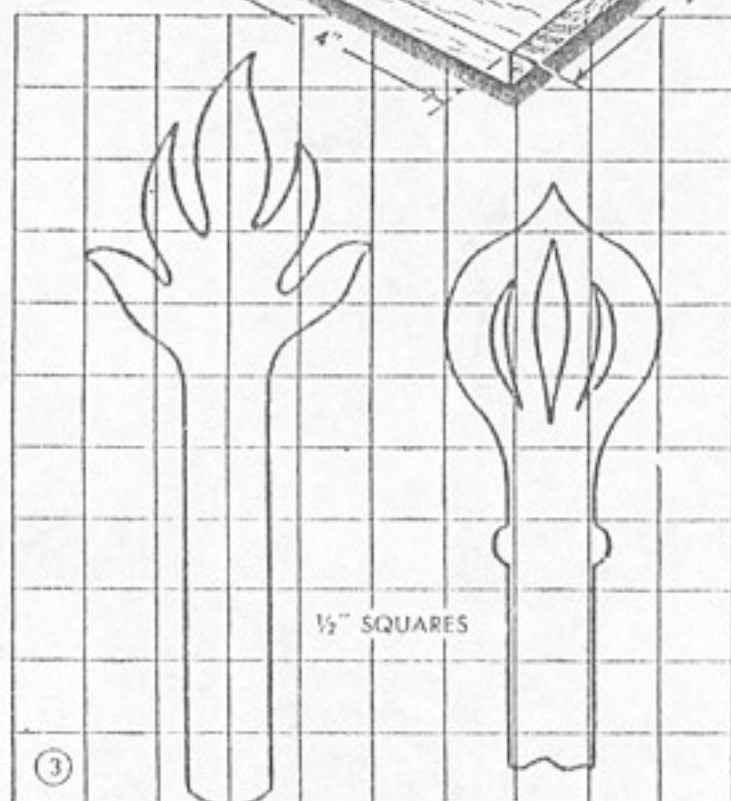
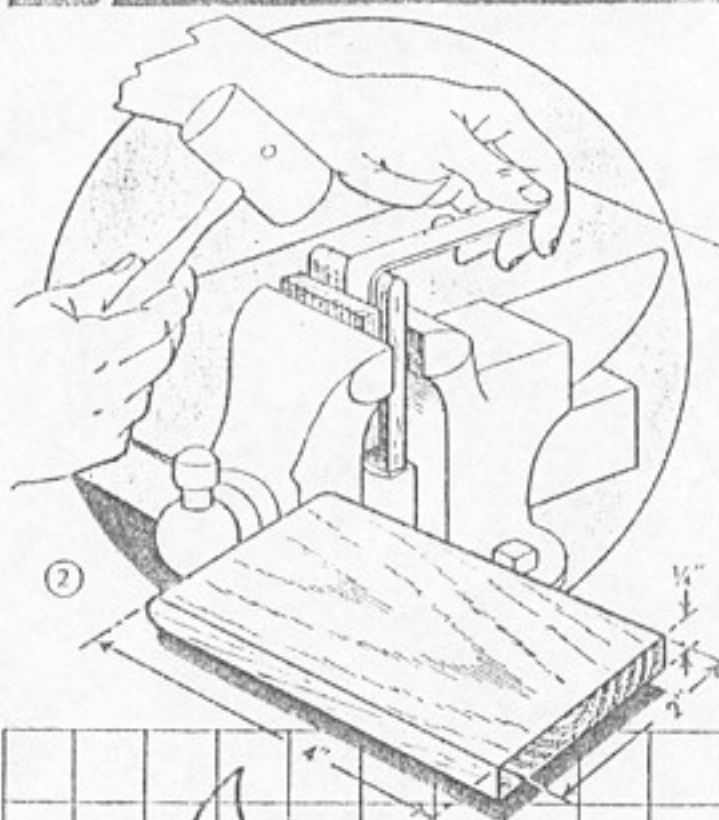
in with a grease pencil, and matches or toothpicks are used for arms and legs. The parts can be attached firmly enough with certain types of modeling clay or wax jammed into the cones. Blobs of the modeling material make feet that let the figures stand upright.—SIDNEY POTT.



JEWELRY



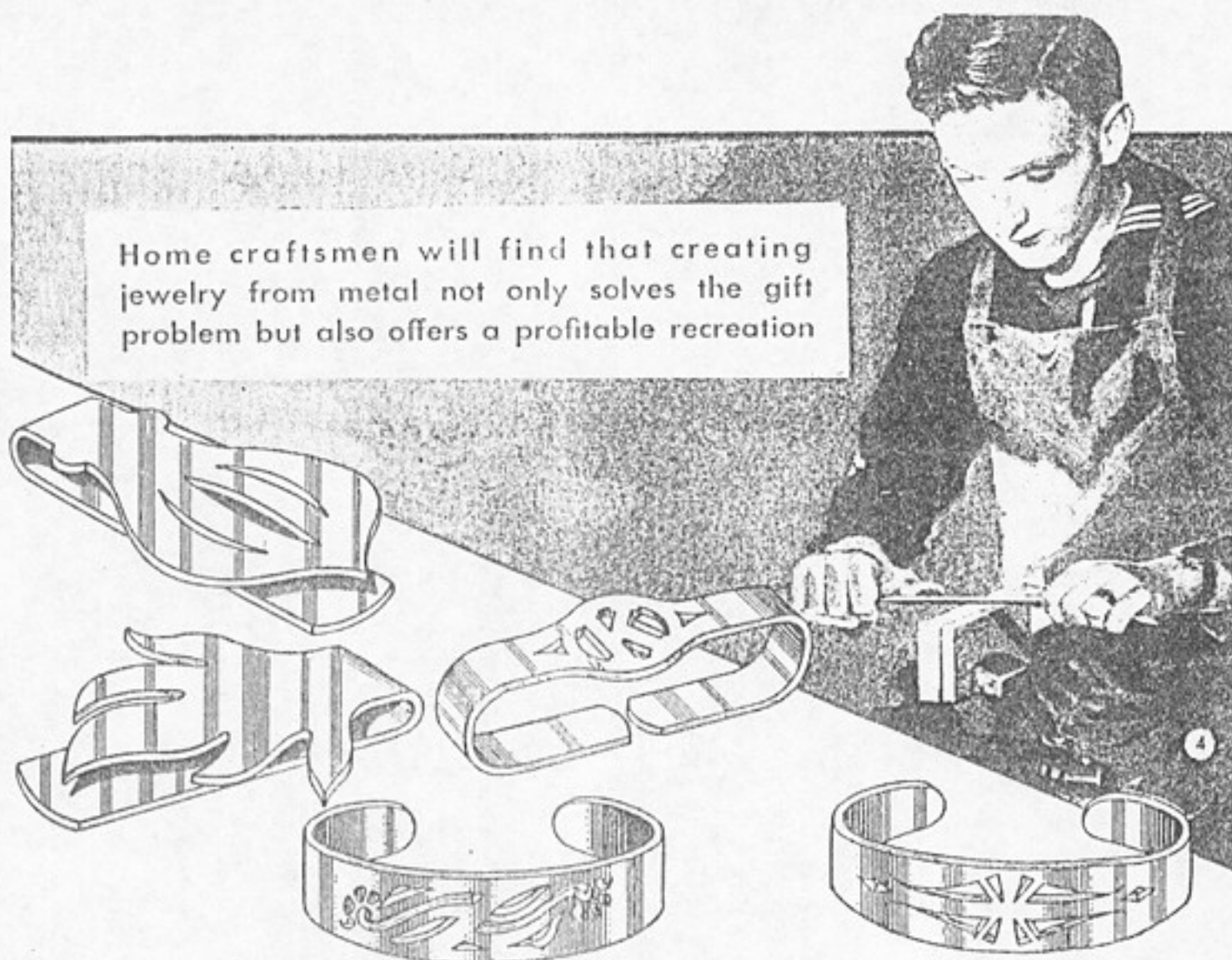
POPULAR MECHANICS 1951



MANY attractive and unusual articles of jewelry, such as napkin clasps and rings, bracelets, pins and brooches, can be made from small pieces of sheet metal. The work is learned easily, requires only a few common hand tools and provides unlimited opportunity for originality in design. Novelty jewelry makes an ideal gift and for this reason it finds a ready market wherever souvenirs are in demand.

Materials: Half-hard aluminum, soft brass, cold-rolled copper, German silver, nickel and many other metals and alloys are suitable, the thickness, or gauge, of the metal depending on the article to be made. For napkin clasps and rings, 16-gauge metal is suitable, but for pins and other ornamental items, metal as light as 36 gauge, which is a little less than $\frac{1}{64}$ in., can be used.

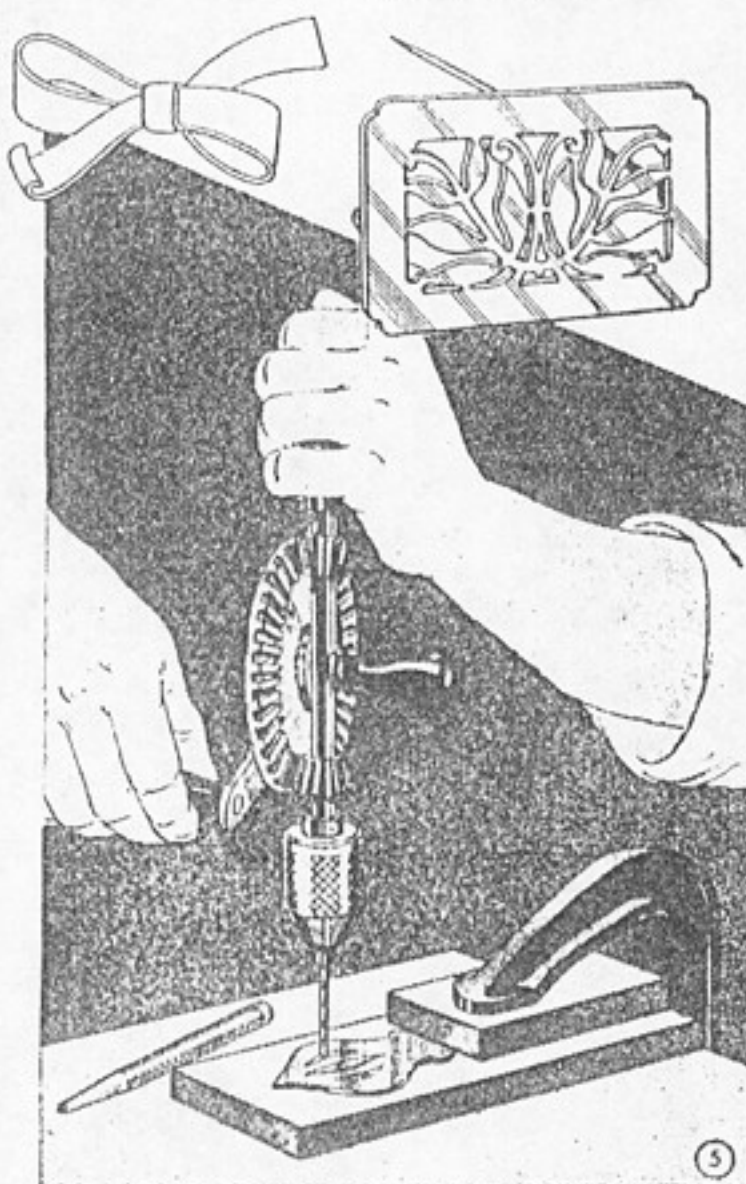
Napkin clasps: These popular and useful articles not only are the easiest to make, but illustrate the procedures to be followed in fashioning the more difficult pieces. From a sheet of 16-gauge aluminum or German silver, a strip 2 by $5\frac{1}{4}$ in. is cut with tin snips as in Fig. 13. A design such as one of those shown in Fig. 3 is drawn on paper, which is cemented to the metal strip. Shellac or rubber cement can be used as an adhesive. When this has dried, the metal is trimmed down roughly to the shape of the design, then scrollsawed to finish size. For sawing, a notched and slotted board is used as in Fig. 1. The board is clamped to the workbench and the metal is positioned so that the lines to be sawed are over the notched cutout. The work should be held firmly on the cutting board



to prevent vibration while being sawed, as this may cause the blade to break. With the blade teeth pointing toward the handle, the saw is tilted forward slightly except when cutting a sharp corner. This must be done slowly to allow the blade to clear away enough stock to turn without binding or breaking. Wax rubbed on the blade will serve as a lubricant so that it will cut freely.

When using a design like that shown in the right-hand detail of Fig. 3, portions of the metal must be sawed out. This is done by first drilling small holes through which the saw blade can be inserted. The work is clamped between two wood blocks as in Fig. 5 so that the drill will cut through the metal without damaging the workbench. The locations of the holes should be center-punched before drilling so that the drill will not slip out of place and scratch the metal.

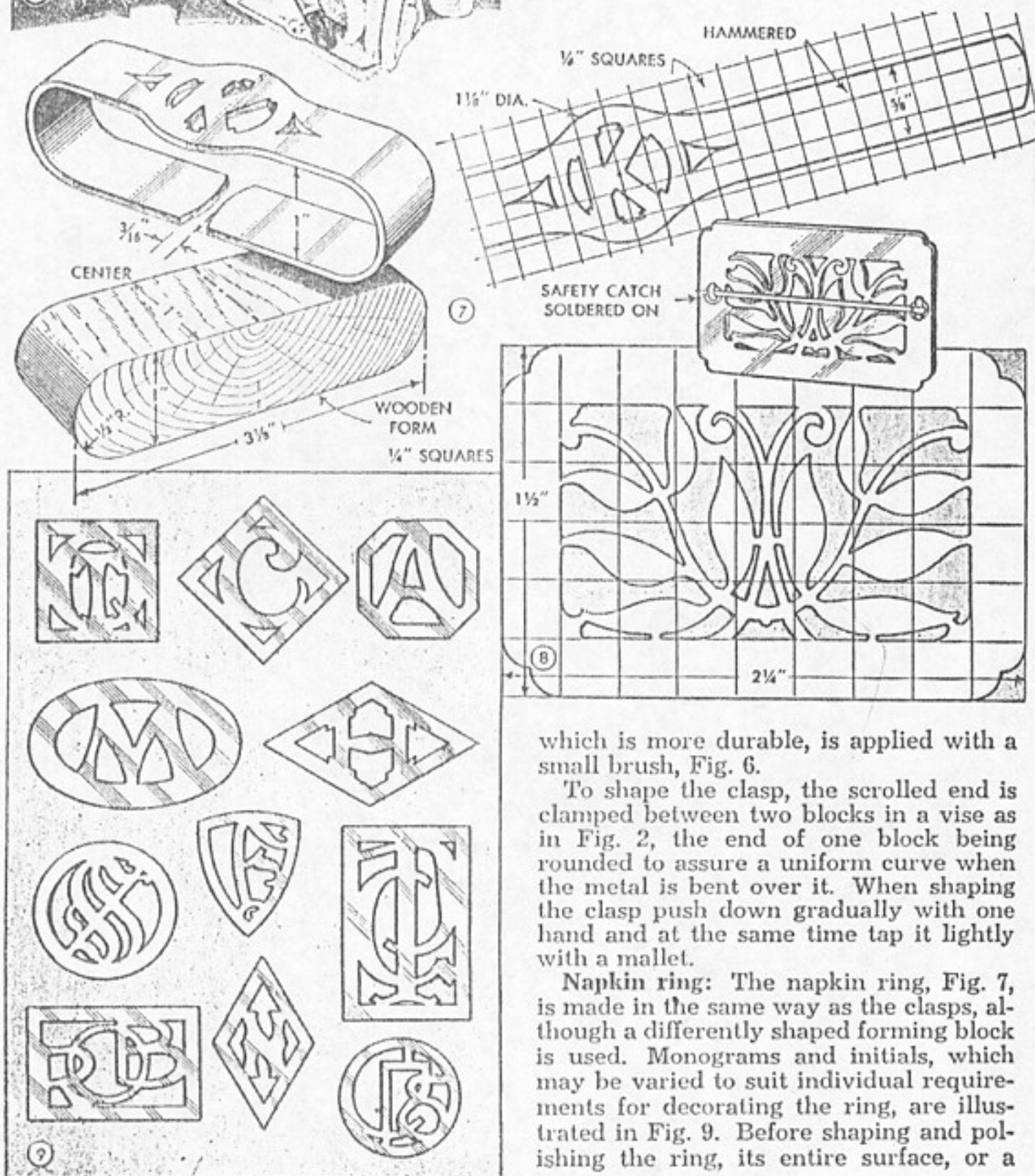
After all sawing has been done, the edges are smoothed by draw-filing. The work is held in a vise between two blocks of wood, which are placed about $\frac{1}{8}$ in. below the edge of the work in order to give greatest support to it. A small mill file then is gripped with both hands and drawn flat in one direction only along the edge of the





metal, Fig. 4. Because aluminum and other soft metals clog a file quickly, chalk should be rubbed on the file frequently to prevent its filling up. When all edges have been filed smooth, they should be rubbed down with a strip of medium emery cloth followed by a strip of No. 0 cloth.

The metal is polished with a fine abrasive such as powdered pumice or ordinary kitchen scouring preparations applied with a damp cloth. Fine steel wool can be used to produce a dull, rich finish, but for a bright luster jeweler's rouge, or metal polish such as used on automobiles, can be applied with a felt pad. Then paste wax is rubbed on to protect the finish, or lacquer,

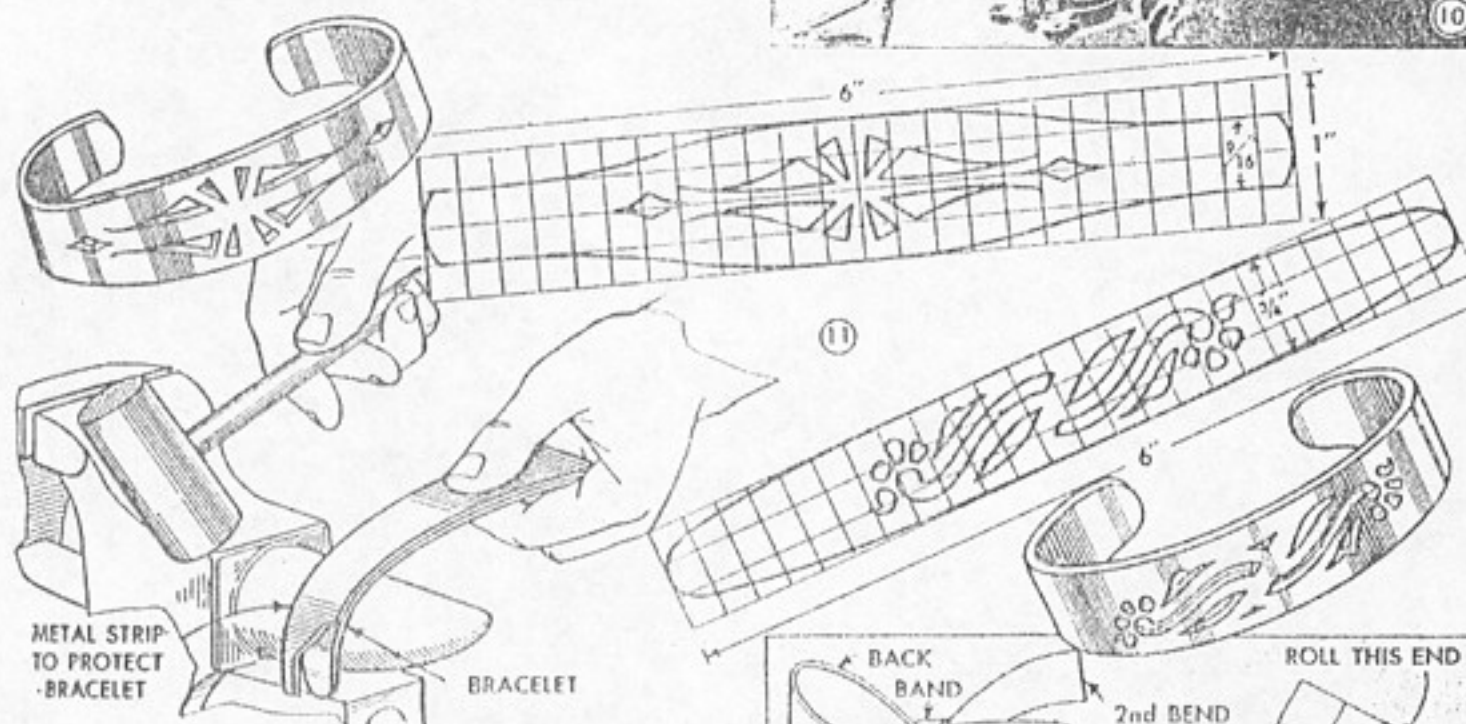


which is more durable, is applied with a small brush, Fig. 6.

To shape the clasp, the scrolled end is clamped between two blocks in a vise as in Fig. 2, the end of one block being rounded to assure a uniform curve when the metal is bent over it. When shaping the clasp push down gradually with one hand and at the same time tap it lightly with a mallet.

Napkin ring: The napkin ring, Fig. 7, is made in the same way as the clasps, although a differently shaped forming block is used. Monograms and initials, which may be varied to suit individual requirements for decorating the ring, are illustrated in Fig. 9. Before shaping and polishing the ring, its entire surface, or a

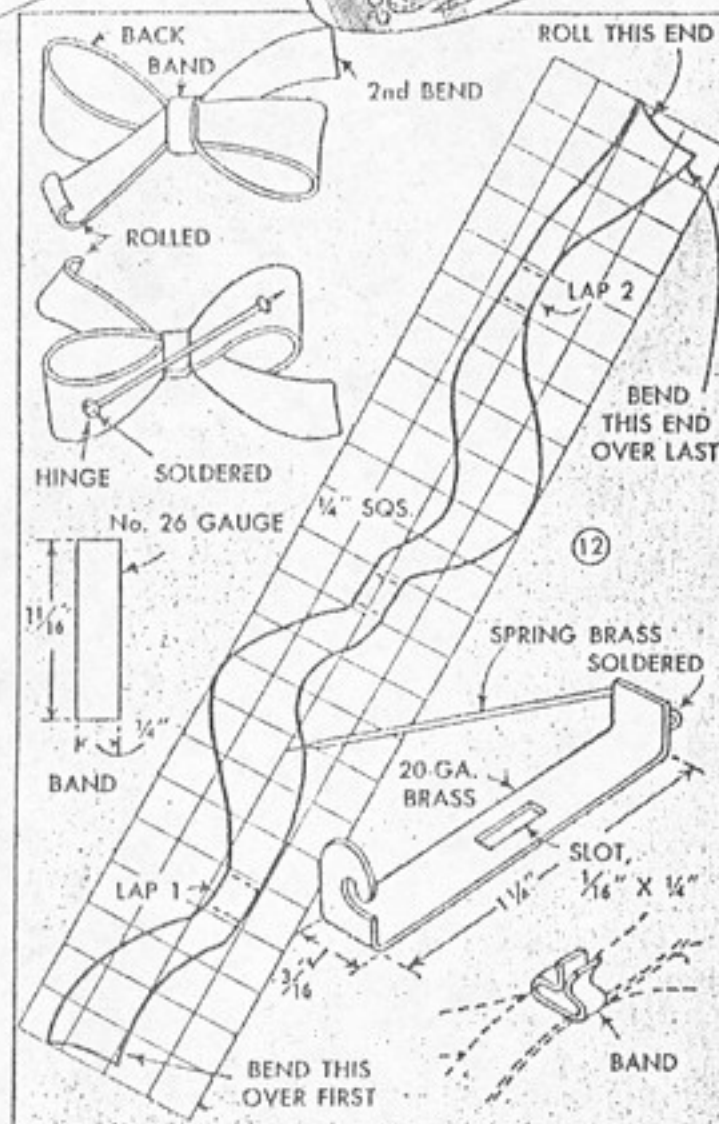
small portion of it, can be hammered to produce a pleasing effect. This is done by tapping the surface lightly with a ball-peen hammer, or by indenting the surface with a punch made by rounding one end of a short length of $\frac{3}{8}$ -in. dowel. To bend the ring, a line is marked on one side of the forming block across its center, and the strip of metal, after being scrollsawed, filed and polished as previously explained, is positioned over it so that half its length extends on each side of the line. The strip, of course, must be aligned carefully along the edges of the block so that, when bent, the ends will meet exactly. Then the strip is covered with a small wooden block and

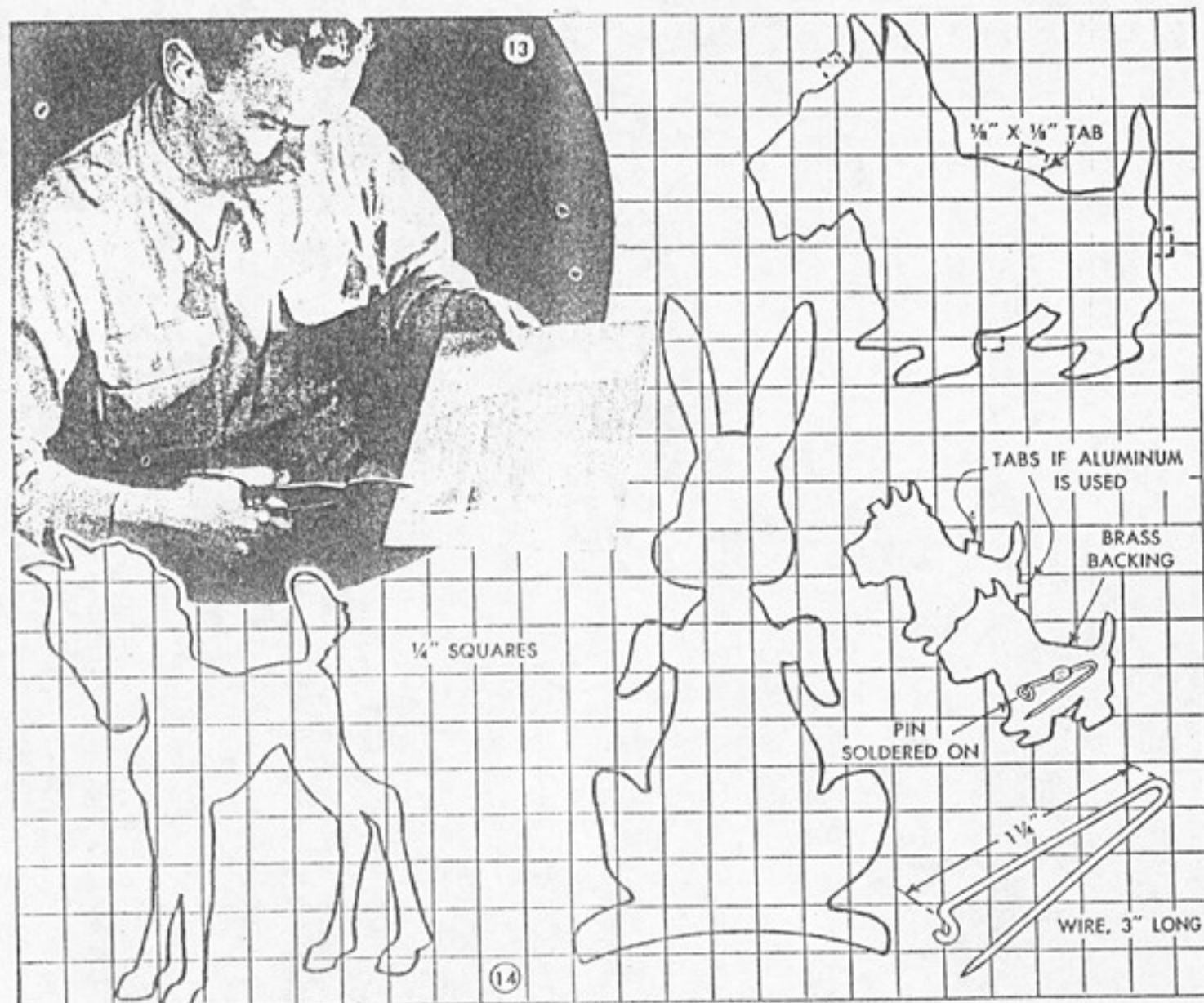


clamps are tightened over the work, after which the ends are bent and tapped with a mallet until the ring is completely formed.

Filigreed bracelets: Although they are made in much the same way as the napkin rings, the bracelets shown in Fig. 11 require a little more experience because of the intricacy of their designs and the small portions to be sawed out. Nickel or German silver is preferable to brass, copper or aluminum for making bracelets. These are formed over the end of an anvil as in Fig. 10. When doing this work, care must be taken to avoid distorting the web pieces of the design. For this reason, a thin metal strip is laid over the work to protect it while it is tapped with a mallet, as indicated in the lower left-hand detail of Fig. 11.

Pins and brooches: Several kinds of pins and brooches are shown in Figs. 8, 12 and 14. For the filigree-type brooch, Fig. 8, 20-gauge silver or German silver is suitable. When sawing metal of this thickness, it is best to use the slotted end of the sawing board shown in Fig. 1, rather than the notched end, so that the work will be well supported. If the piece buckles under the





saw, the kinks may show even after the piece is straightened again, and such defects are enough to ruin the material for this purpose. A regular pin back with safety catch, available at jewelers' supply houses, is soldered on the back.

The bowknot pin, Fig. 12, is light enough to be worn on a blouse, as it is made from 36-gauge silver or German silver, which is cut with small tin snips. Before bending the cut-out strip according to the cross-hatched pattern, one side can be polished to a high gloss and the other side can be rubbed to a dull, satin finish so that, when the strip is folded as indicated in the upper left-hand details, the alternating gloss and satin finish will give a pleasing, silky appearance. After bending the strip, a band of heavier stock is wrapped around the center and soldered at the back. A pin back may now be soldered in place. If the pin is made of aluminum, a strip of brass, cut and shaped as shown in the right-hand detail, can be used instead. The brass strip is provided with a slot through which the ends of the band are slipped and peened to hold them in place.

Silhouettes of animals, Fig. 14, are always popular as pins, but trees, leaves, or sketches adapted from illustrations can be

used. Copper or brass is attractive, although aluminum also is satisfactory. However, if aluminum is used the pin fastening cannot be soldered to the back unless special solder is used. Instead, tabs should be provided for folding over a brass backing to which the pin can be attached, as indicated in the right-hand details of Fig. 14. If a pin back or pin mounting is not available, one can be improvised from a length of spring wire, or an ordinary safety pin may be substituted.



FEMININE EYES WILL SPARKLE OVER THESE

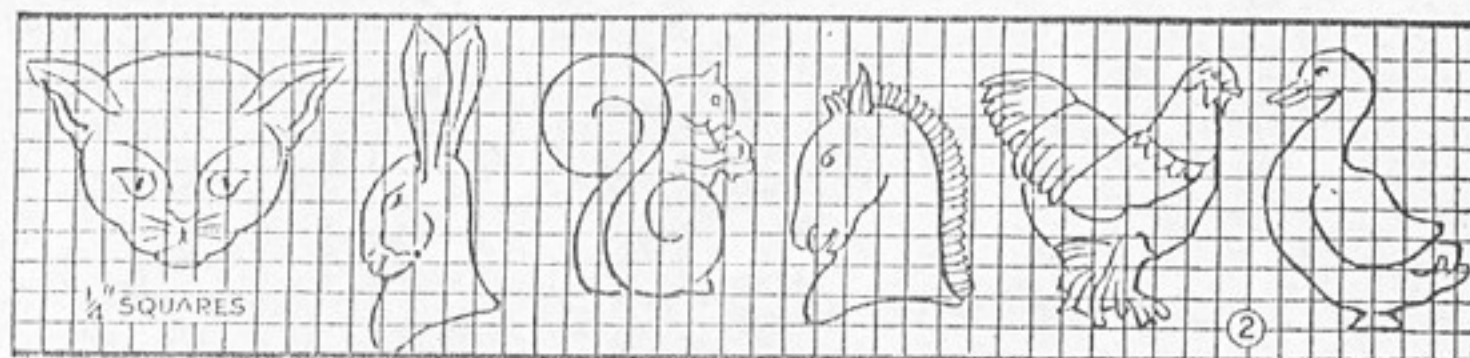


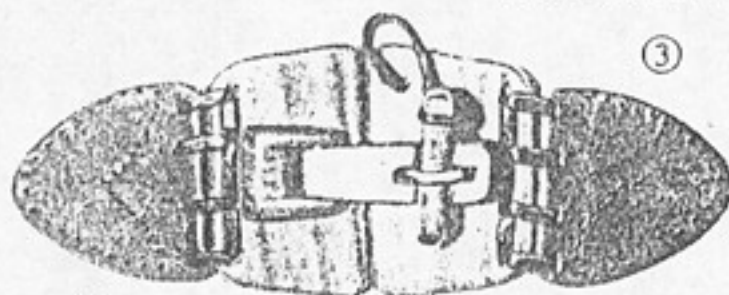
Fifteen novel dress-pin designs to carve in wood. All you need is a coping saw, a jackknife and sandpaper

YOU'LL want to remember someone this Christmas with a gift of these smart wooden dress ornaments. They're fun to carve and not at all difficult, as the photos in Figs. 1 and 5 make it easy for you to see just where to whittle and the right contour to duplicate. Patterns for the ornaments shown in Fig. 1 are given on squares in Fig. 2, so that they can be readily enlarged for tracing on $\frac{3}{16}$ -in. stock. Hardwoods, such as maple, walnut, mahogany, cherry,



After scroll-sawing a figure roughly to size, it's easy to carve it with a jackknife and sandpaper to a smooth finish



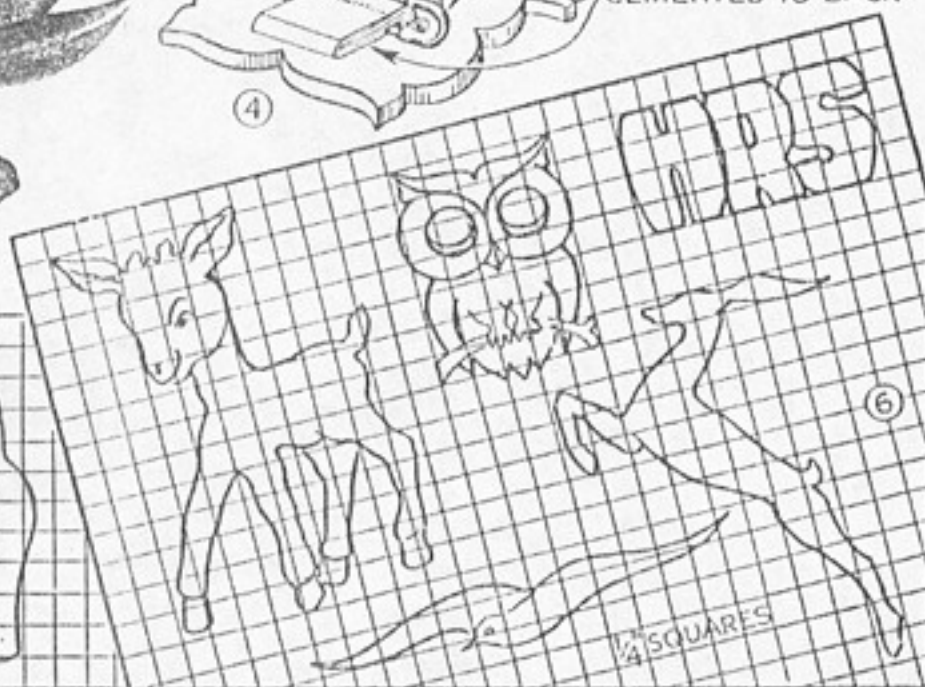
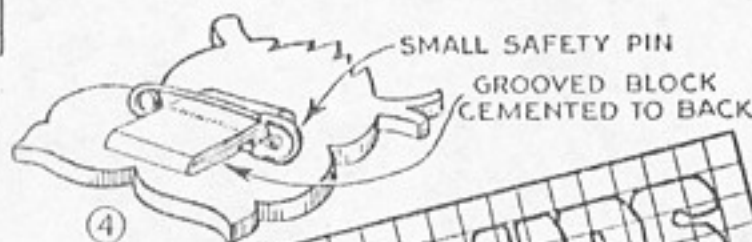
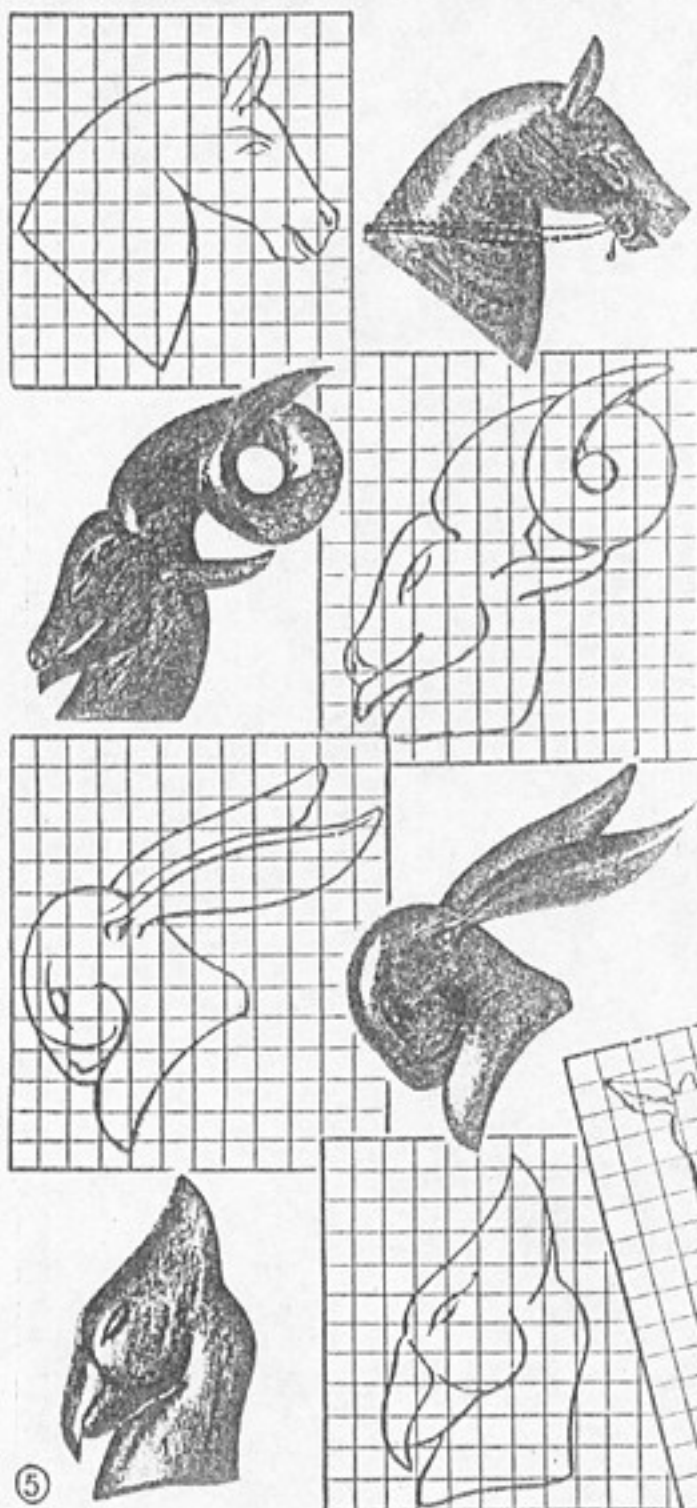


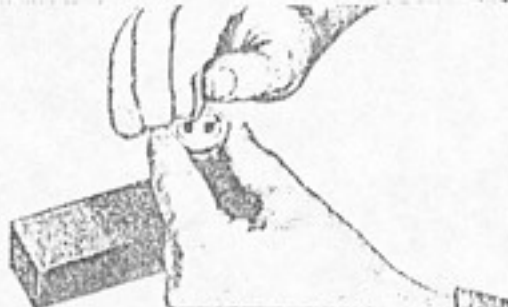
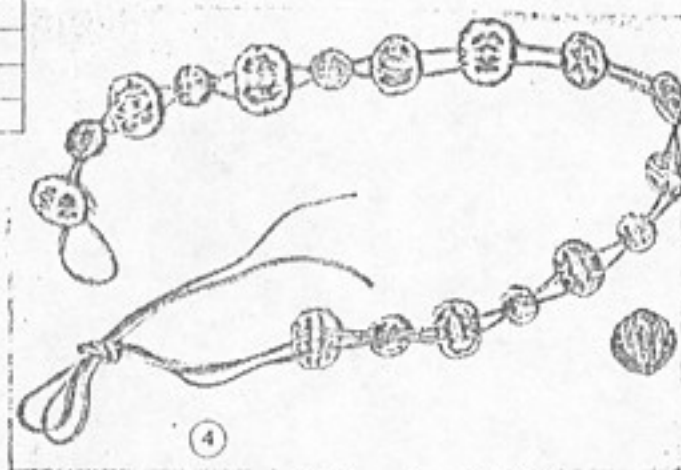
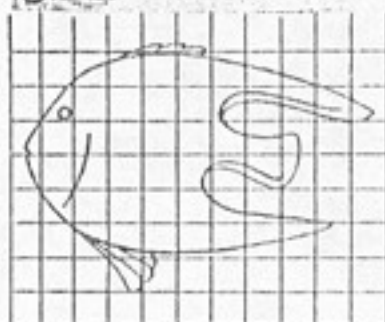
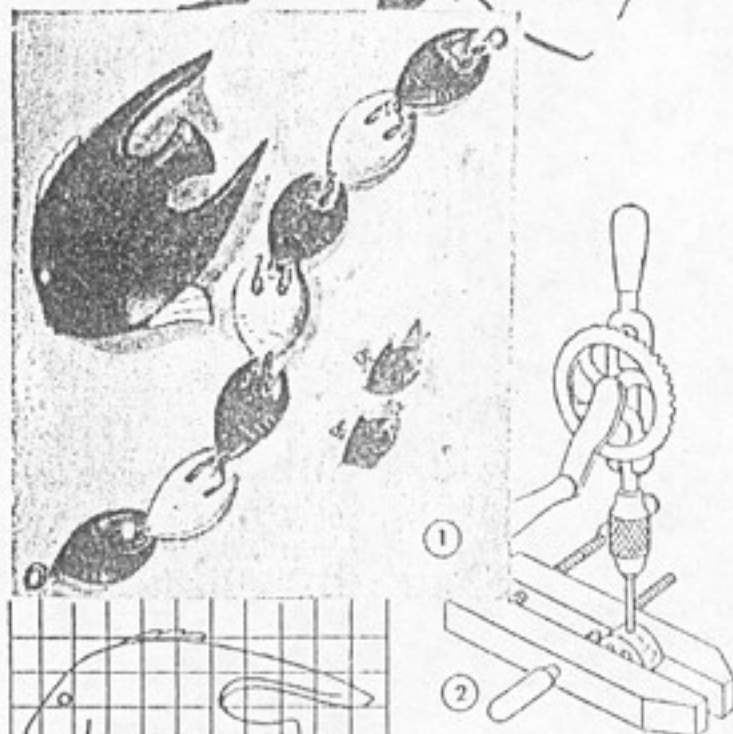
etc., are preferred to softwoods, as the cross grain is stronger and a higher polish can be had in finishing.

If you have a scroll saw, you can saw out as many as ten blanks of one kind at a time by stacking and bradding the layers together. In carving, mouth and eyes are outlined with clean-cut V-grooves while contours are shaped by sloping the cut to meet a vertical one. For example, the squirrel's body and tail in Fig. 1 are formed by the latter method, the eye being simply a deep V-cut accentuated with black ink.

The ornaments can be sanded or left rough-carved and may be finished with several coats of hot linseed oil rubbed to a rich luster with a soft cloth, or finished with wax, shellac or varnish. Toning provides still another variation for finishing the figures. For instance, the little fawn, shown in Fig. 6, can be two-toned by staining the hoofs and nose black and the upper part of the body and legs brown.

Fig. 4 shows how a common safety pin can be attached to the back of the figures to provide a suitable clasp, or clasps made for the purpose can be purchased. Monograms, Fig. 6, and belt buckles, Fig. 3, are other examples of what can be done.





THE hobby of nutcrafting offers many new possibilities for craftsmen who like unusual novelties. Servicemen especially will find it an intriguing test of manual skill. Costume jewelry and other objects made from nutshells always are prized highly as gifts. In nutcrafting you're not limited to the hard and soft-shelled nuts alone. Plum stones, which grow in several different colors, including red, tan and brown; date stones, generally mottled in effect, and pits from cherries may be used. Shells from more than one variety often are used in working out designs for necklaces, such as shown in Figs. 6 and 9, and the bracelet in Fig. 7, as well as the belt, Fig. 4. An ensemble consisting of a lapel pin, bracelet and earrings, Fig. 1, can be made from coconut shell, which is sawed easily as in Fig. 13.

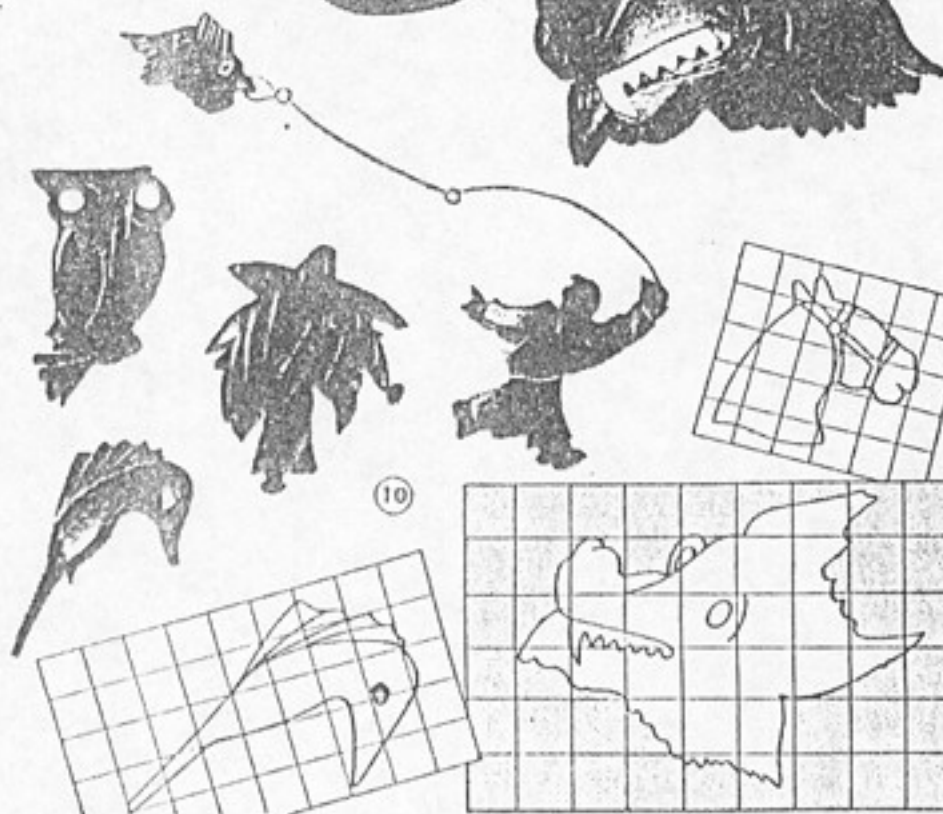
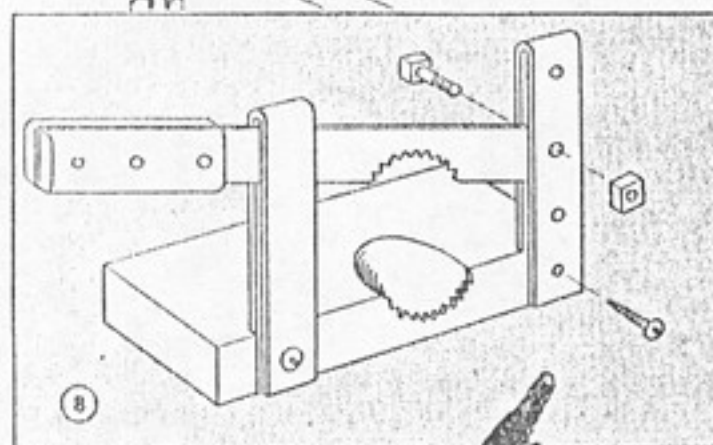
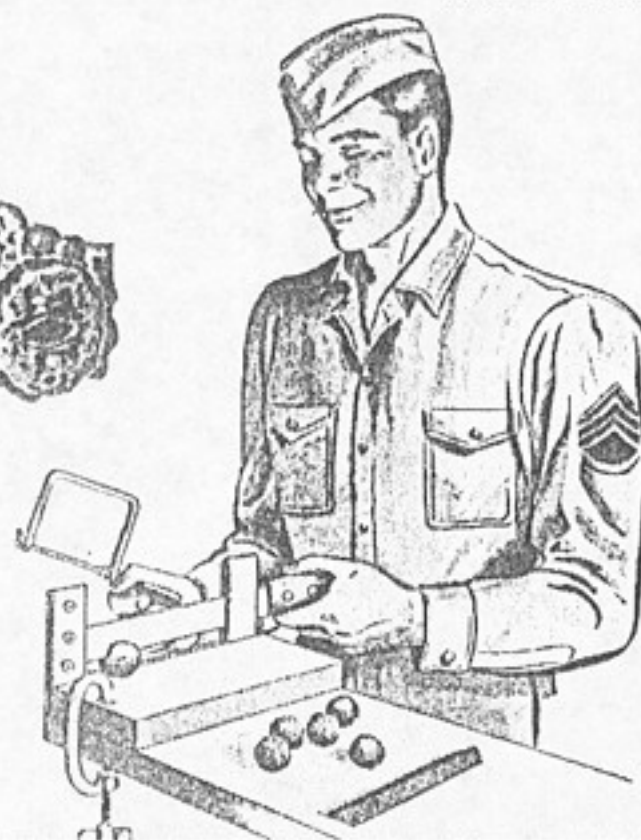
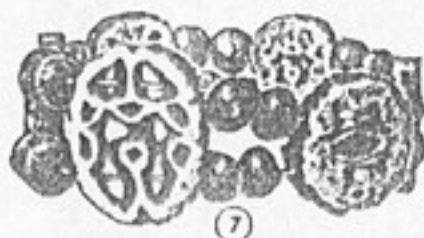
Only a few tools are needed. A small hand drill, Fig. 2, several files and a supply of fine-grit sandpaper, Fig. 5, will take care of most of the finishing operations. A special clamp, made from light flat iron and hacksaw blades as in Fig. 8, will serve to hold the nutshells in place while sawing. A coping saw with an assortment of fine-toothed blades is a necessity. The cross-hatched patterns such as that at the left of Fig. 2 and those just below Fig. 10 are included merely for the purpose of enabling you to trace the outlines and transfer these

to the surface of the work. The exact size or detail will be determined by the area of the shell or whatever design suits your fancy.

Small holes, either for stringing or for ornamentation, can be drilled through the "slices" or other parts of the shells as in Fig. 2, using a carpenter's wood clamp as shown. For stringing the finished parts of shells, use fine jewelry chain, leather thong or elastic cord.

If you use fine-toothed coping-saw blades in the slicing operations you won't have much trouble removing the saw marks from most shells. However, this must be done with care, for in nutcrafting the finish is the thing. The polished surfaces of most of the shells used in this work will take a beautiful finish even in the natural color, so it pays to do a thorough job. Producing a suitable surface on the flat-faced slices, such as those in the belt, Fig. 4, is simply a matter of persistence with file and sandpaper in successively finer grades, preferably of the "wet-or-dry" type. Sometimes the finishing operation can be speeded up by tacking a sheet of 8-0-grit paper to a flat surface such as a table top, then rubbing the slice back and forth on the abrasive. This will produce the desired smooth surface with uniform sharp edges.

Working down curved or convex surfaces can be made much easier if you take





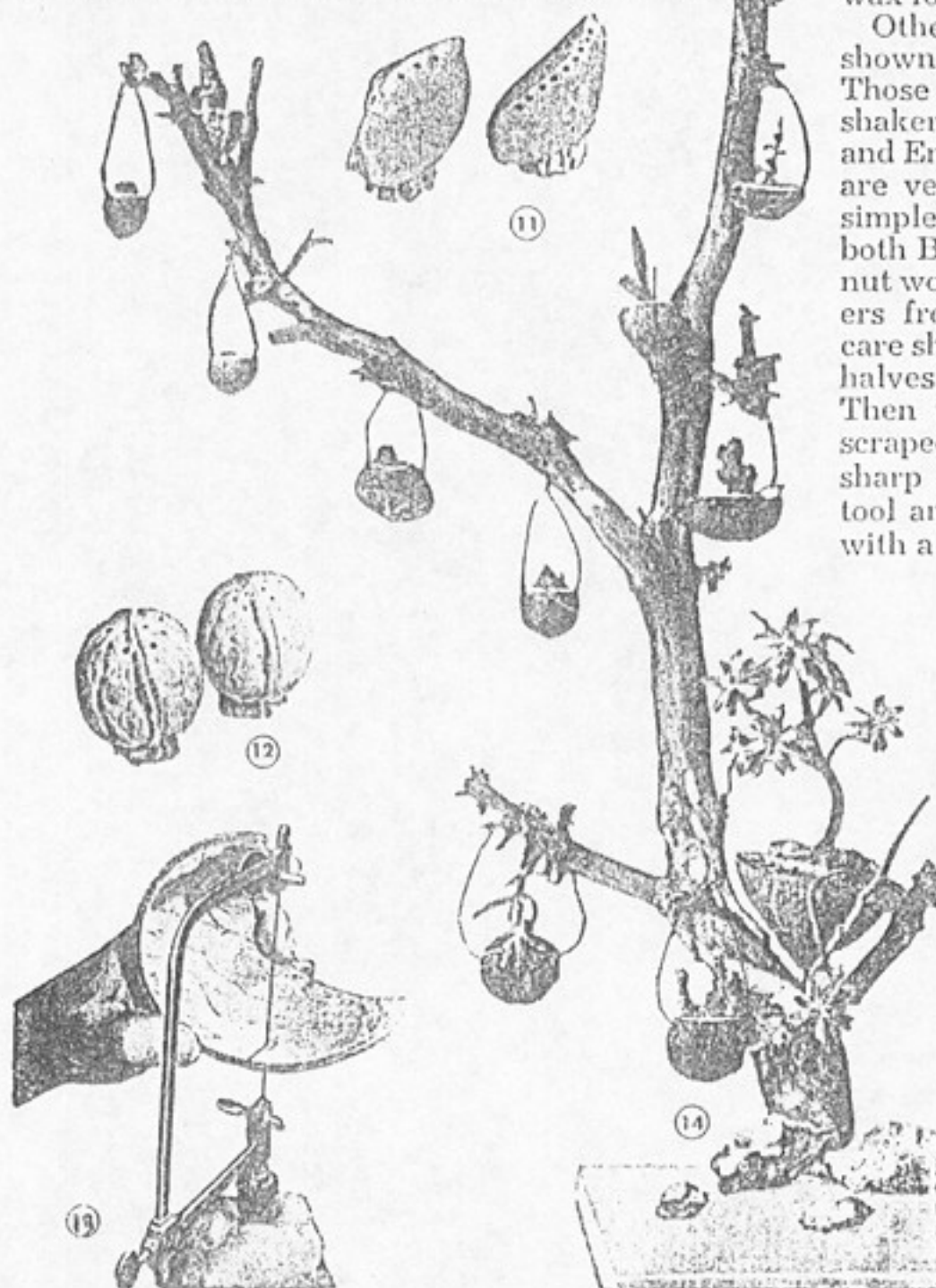
time to make the small fixture shown in Fig. 3. By pressing the edge of the nutshell against the heads of the nails you can work on any part of the curved surface clear down to the edges with either file or abrasive paper.

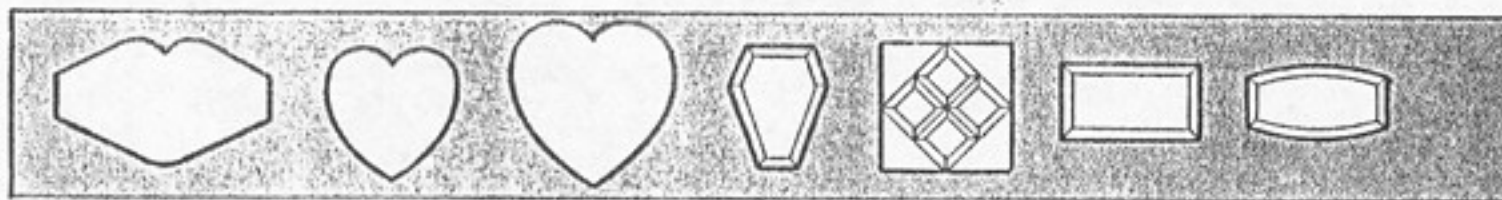
Carving nutshells is, of course, something else. However, if you have the skill and inclination, much can be done in the field of nutshell carving either by hand with a sharp pocket knife or with an electric grinder of the hand type, using wood-cutting burrs. Usually the final polishing is done with a very fine abrasive paper known as "granite" paper, and also with jeweler's rouge.

As a finishing material some nutcrafters work the oil out of the nut meats with a mortar and pestle and use this oil as a stain and polish, rubbing it on with the fingers to give the polished surfaces color and tone. Others use wax for a natural finish.

Other nutshell novelties are shown in Figs. 10, 11, 12 and 14. Those in Figs. 11 and 12 are salt shakers made from Brazil nut and English walnut shells. These are very popular items and are simple to make as the shells of both Brazil nut and English walnut work easily. In making shakers from English walnut shells care should be taken to break the halves apart without cracking. Then the inside of the shell is scraped and smoothed with a sharp knife or a wood-burring tool and the halves reassembled with a quick-setting adhesive. A

single large hole is drilled in the bottom to take a cork which serves as a base. With shakers made from irregularly shaped shells such as those of the Brazil nut, it is necessary to make a base from a shell of contrasting color. Fig. 14 shows an unusual novelty display made up by using a tree limb on which are hung several nutshell baskets made from various kinds of small shells, the principal feature being a flowerpot made from a coconut. Of course, other arrangements are possible.





MOTHER-OF-PEARL JEWELRY CUT FROM

POPULAR SCIENCE NOVEMBER, 1945

By Nicholas S. Tranchina

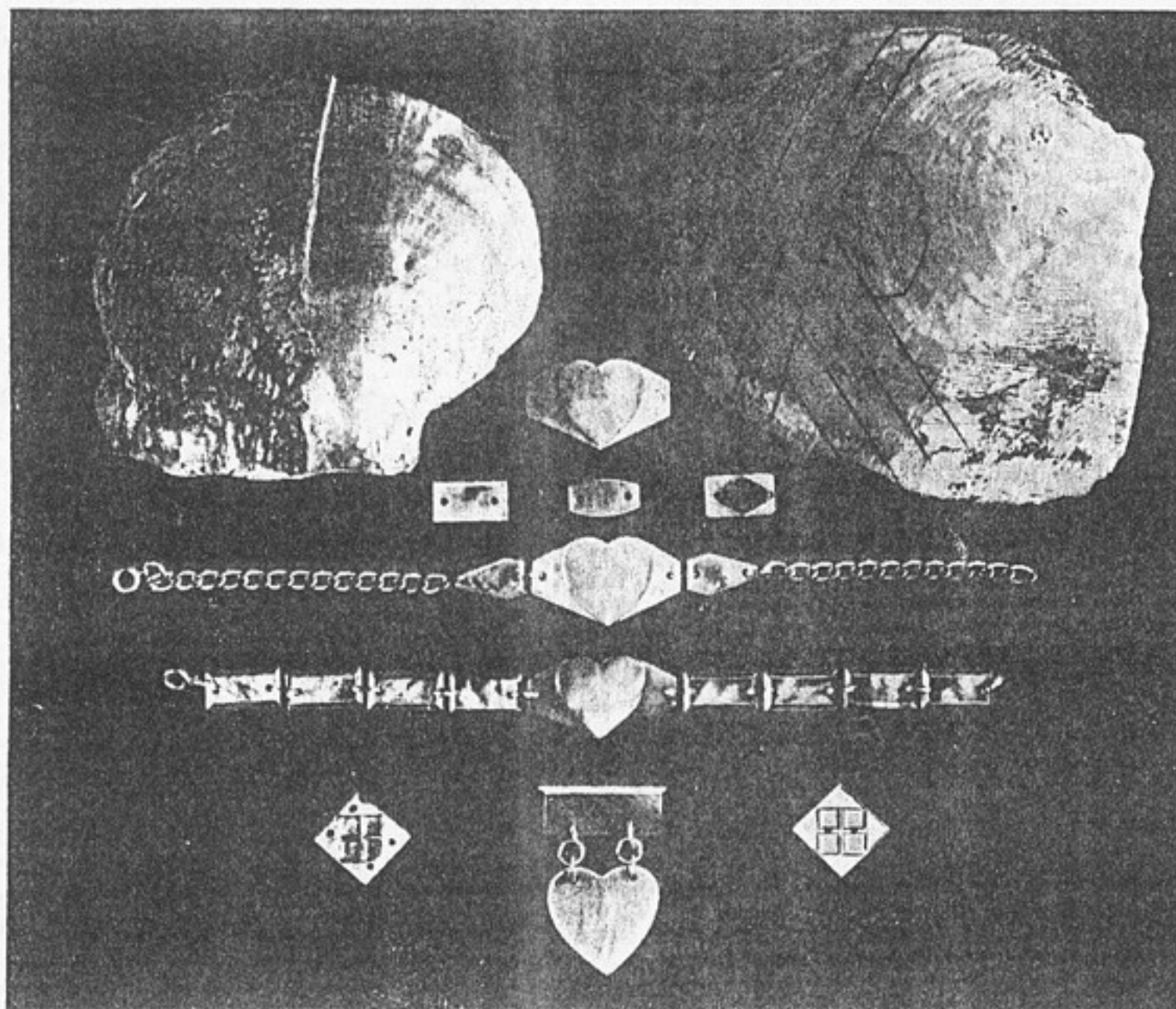
THOSE who visit the seashore, and inland waters as well, have the means of an interesting and profitable hobby at hand. Shell gathering has always held an attraction, for many shells have an intrinsic beauty that makes them ornamental in themselves. These same shells, and some that show less immediate beauty, can be ground, sawed, and filed into shapes that make up into handsome jewelry and other trinkets.

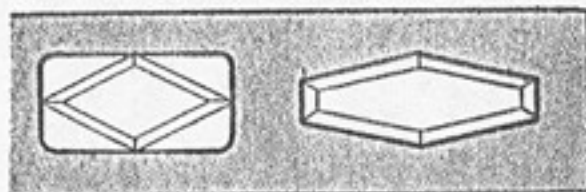
True mother-of-pearl is available in abundance from such shells as those of pearl oysters, river mussels, and abalones, but the inner layer of conch, clam, and common

oyster shells and some others is quite as serviceable and often as delicately colored. The coarse outer layers must first be ground off. A shell with these coarse layers half ground off is shown at the upper left of the photo below.

Patterns of tin-can stock or other material are laid on the shell and traced, as at the upper right in the photo below, where the straight lines are for strips that can be cut into links. Saw these with a hacksaw, and then saw the centerpiece, which should be from the best part of the shell. Links may be $\frac{3}{32}$ " thick, centerpieces $\frac{1}{8}$ ". Patterns for several kinds of links and centerpieces may be traced from the drawings above.

Shape pieces with a file, bevel or round



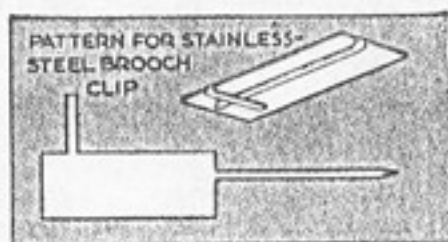


SEA SHELLS

the edges, and drill with a 1/16" dental or regular short drill. Sand off scratches and polish with jeweler's rouge or stick metal polish.

Stiff link wire can be purchased a foot or two at a time from a jeweler's supply house. To make links, wind it around a nail and saw through along the length of the nail. A brooch clip is made as shown below.

If shells are unavailable, old shell and mother-of-pearl buttons will afford material.

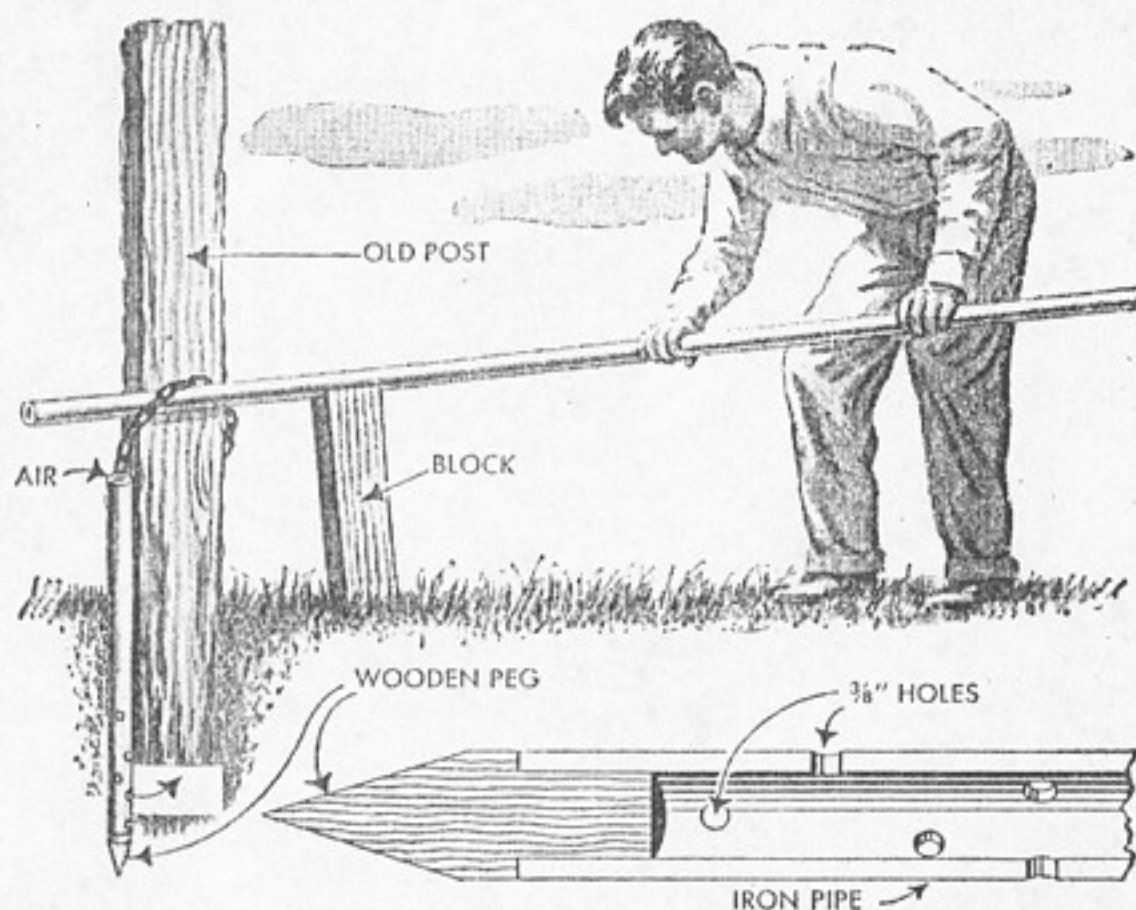


POPULAR MECHANICS, 1948

Pipe Vent Simplifies Removal of Posts From Soggy Ground

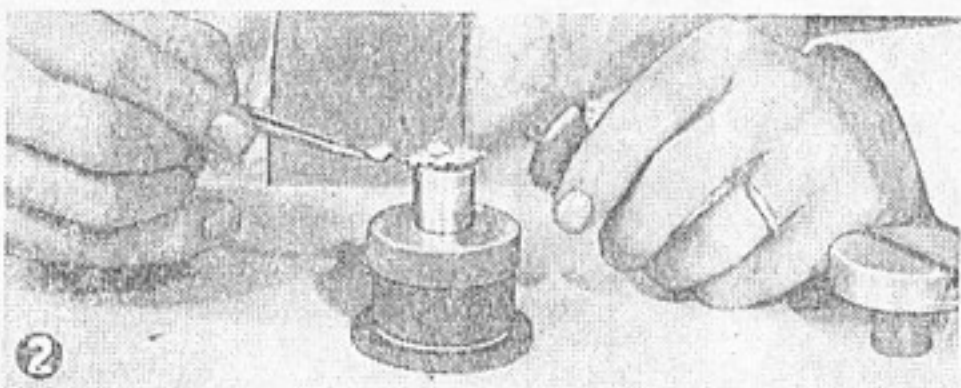
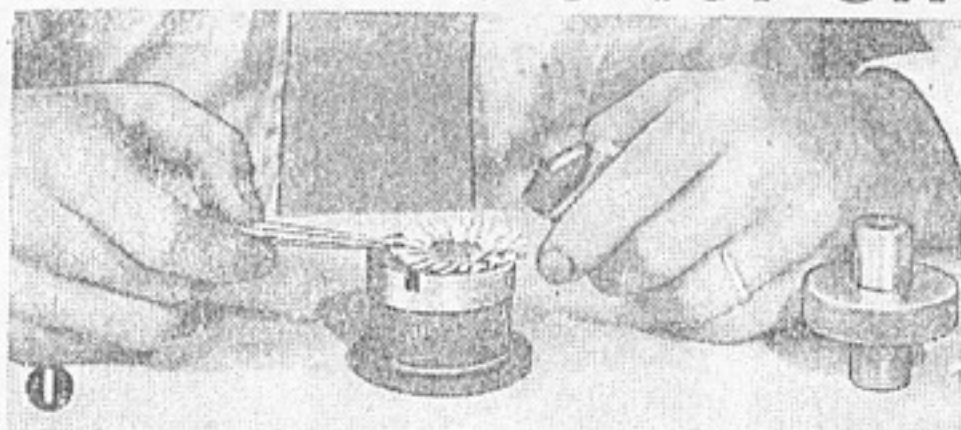
Pulling posts from soggy ground often is difficult because of the suction created by the vacuum at the bottom of the post. However, if a length of pipe is plugged and drilled as shown and driven into the ground beside the post, removal will be easier because air admitted through the pipe will tend to break the vacuum.

☐ The tip of a soldering iron can be reshaped or cleaned on a coarse-grit disk or belt sander. This is faster than hand filing, and no time is wasted cleaning a file which has been used on copper.



Turntable for Shellcrafters

By GERALD W. HALL



SHELLCRAFTERS, who often wish they were blessed with 3 hands instead of 2, will find this turntable a useful gadget when working on brooches and earrings. It is handy when cementing outer borders of garfish scales on plastic foundations. It eliminates the awkward problem of holding both the tube of cement and the plastic foundation with the left hand.

First turn the base to shape from 2 in. dia. cold-rolled (cr) steel (Fig. 3). Metal is used because its weight will keep turntable from sliding on work table. With piece held in a 3-jaw chuck, face off one end; this will be the end on which turntable revolves, and should be perfectly smooth. Now, center drill, drill with a $\frac{1}{16}$ in. drill, and ream with a $\frac{3}{4}$ in. reamer. Turn $1\frac{1}{2}$ in. dia. for a distance of $\frac{3}{4}$ in. Finally, cement a disc of soft felt to the bottom of the base.

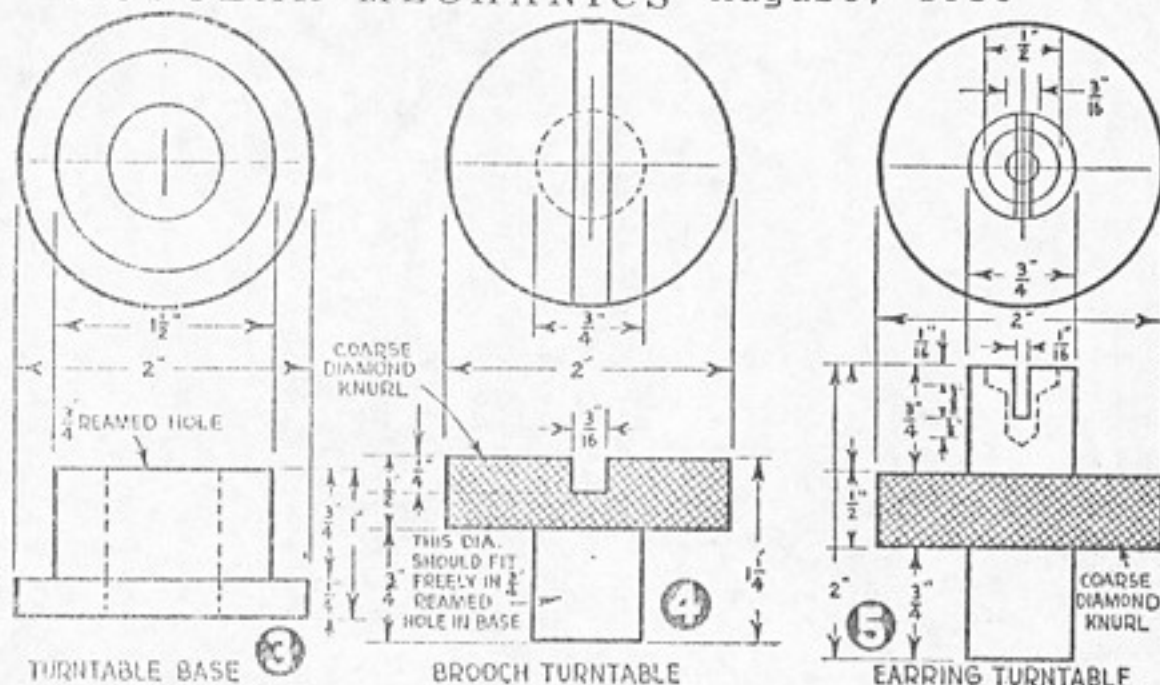
If milling facilities aren't available, make the 2 turntables from either brass or aluminum. By using a soft metal, you can easily make the grooves with a hacksaw and file. Turn brooch turntable from 2 in. dia. stock (Fig. 4). Face off one end and turn $\frac{3}{4}$ in. dia. for a distance of $\frac{3}{4}$ in. Check this diameter with $\frac{3}{4}$ in. reamed hole in the base. The $\frac{3}{4}$ in. dia. should be turned slightly under $\frac{3}{4}$

in. to allow it to turn freely in the reamed hole. Now reverse the piece in the chuck and face the other end. Knurl the 2 in. dia. with a coarse diamond knurl. Groove can either be milled or filed, but make certain groove is wide enough and deep enough to accommodate the largest metal pin-back used. This will allow plastic foundation to lie flat on the turntable. Bevel all sharp edges slightly.

For the earring turntable, again use 2 in. dia. brass or aluminum, and turn to shape (Fig. 5). Face one end and turn the $\frac{3}{4}$ in. dia. for a distance of $\frac{3}{4}$ in. Check this with the hole in the base. Knurl the 2 in. dia. with a coarse diamond knurl for a distance of $\frac{1}{2}$ in. Now reverse piece in the chuck, face off the other end, and turn the $\frac{3}{4}$ in. dia. for a distance of $\frac{3}{4}$ in. Center drill, drill with a $\frac{1}{16}$ in. drill to a depth of $\frac{1}{16}$ in., and drill with a $\frac{3}{16}$ in. drill to a depth of $\frac{1}{2}$ in. Remove from chuck and mill or file the $\frac{1}{16}$ in. wide groove to a depth of $\frac{3}{8}$ in.

This turntable is extremely simple to operate. When working on brooches, first cement metal pin-back to plastic foundation. When cement has dried, place foundation on turntable with pin back in the groove (Fig. 1). You can revolve turntable with one finger as more shells are added. When all shells are cemented in place, lift brooch from turntable with tweezers. Follow the same procedure for earrings, using the turntable designed specifically for earring construction (Fig. 2). You'll find both of these turntables are a real help in your shellcrafting.

POPULAR MECHANICS August, 1950



Settings for GEM STONES

The art of making bezel, prong, cluster, and gypsy settings for your gems

By MURRAY BOVIN

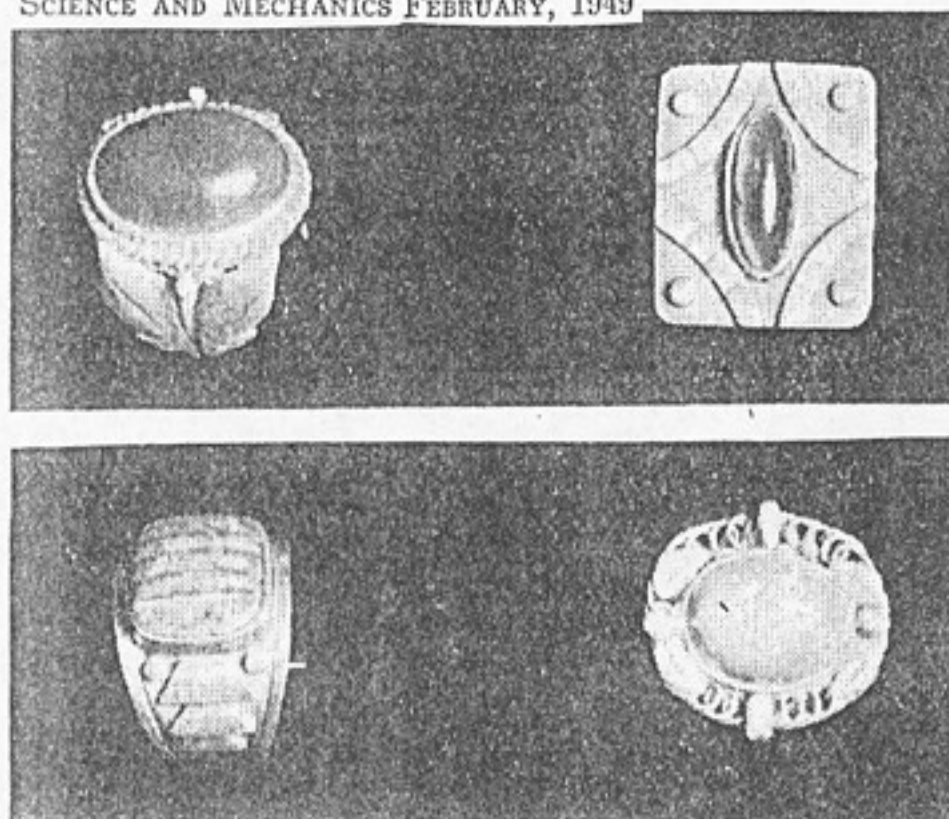
SCIENCE AND MECHANICS FEBRUARY, 1949

STONES, whether semi-precious or precious, when used in jewelry, must be held by a setting. A good setting, in order to enhance the beauty of the stone, is invariably simple, and the type of setting used depends on shape (cut) of stone, its transparency, place of stone in the general design, and use to which jewelry will be put. Four important methods of cutting stones are shown in Fig. 1. Stones, especially the diamond, are also often cut triangle, baguette, hexagon, half-moon, marquise, lozenge, and other ways. Tools you will need for stone setting work are shown in Fig. 2.

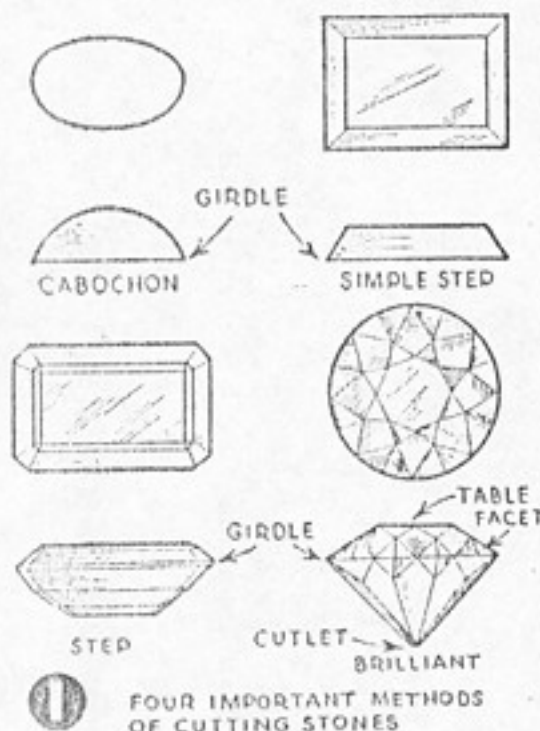
Thickness of the silver, gold, or platinum required to make a setting depends upon size of stone and type of setting. By studying completed settings, you can quickly determine the proper thickness. Holes are usually drilled into the metal by means of a flexible shaft. When soldering, use a higher melting solder first, and as additional parts are added use a lower melting one. Stones may be picked up and fitted into the setting with the aid of bee's wax (Fig. 3).

Bezel Settings

The bezel setting is used primarily for cabochon cut stones, though occasionally it is used for the other cuts. There are two common versions, the box and the bearing types. For the bezel box setting, wrap a thin piece of metal around the girdle of a cabochon cut stone (Fig. 4A). For silver jewelry, 29 gage sterling silver may be used. Cut strip to required size. File and fit edges until they meet perfectly and then solder to form a band. Strip should be cut the right size or a hair line smaller for, if band that it forms is too small, it may be stretched on a small tapered mandrel; if it is too large it must be cut smaller and resoldered. Band may be shaped with pliers and it should fit the stone perfectly but not tightly. If a stone is forced into a tight fitting bezel it is liable to crack. Level one side of bezel on a smooth, flat file or on a rubbing stone. Now solder band to a flat piece of metal to form the box (Fig. 4B). If stone is transparent, remove most of the inside bottom piece of the box and leave just enough metal to form a bearing. File bezel just high enough to hold stone. Stone may be raised by



Ideas for putting different types of stones in bezel settings.

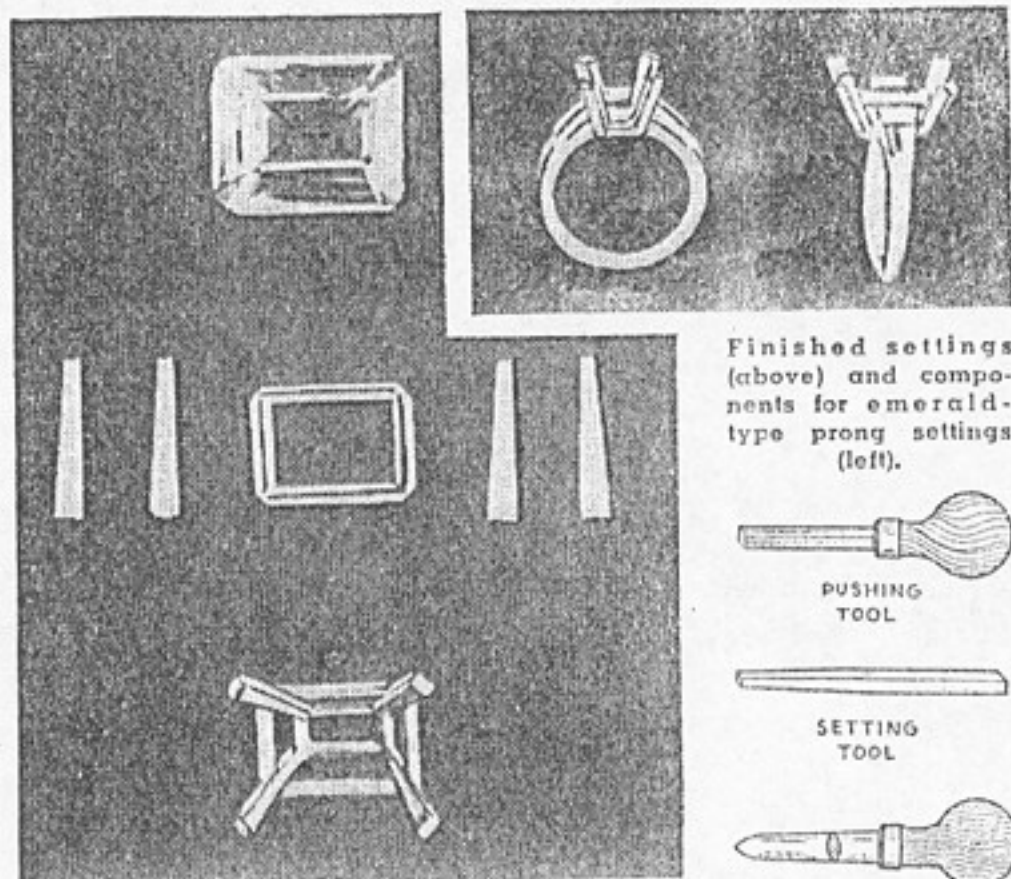


FOUR IMPORTANT METHODS OF CUTTING STONES

dropping in a loose inner bezel. Finally, setting is soldered to jewelry piece. When soldering is complete, stone is set.

Stone may be set in a bezel setting by means of a burnisher, or pushing or pressing tool, or setting tool (Fig. 2). The burnisher is rubbed back and forth over the bezel's edge until bezel is forced over stone. The pushing tool is pressed and sometimes rocked over edge of bezel until bezel is forced over the stone. If you use the

setting tool (Fig. 4C), don't hammer directly against the stone for the vibrations will be transmitted to the stone and may crack it. Hammer at a slight angle to the bezel and hammer on alternate sides to assure centering of the stone. Continue hammering until bezel is firmly against the stone (Fig. 4C). Finally, smooth edge of bezel with a fine barrette (safety edge and back) file. If you have to fit a cabochon into a bezel that is a little too small, grind the girdle



Finished settings (above) and components for emerald-type prong settings (left).

PUSHING TOOL

SETTING TOOL

BURNISHER

FLAT ENGRAVING TOOL

FRAZER

2 BEE'S WAX
3 CABOCHON STONE
TOOLS

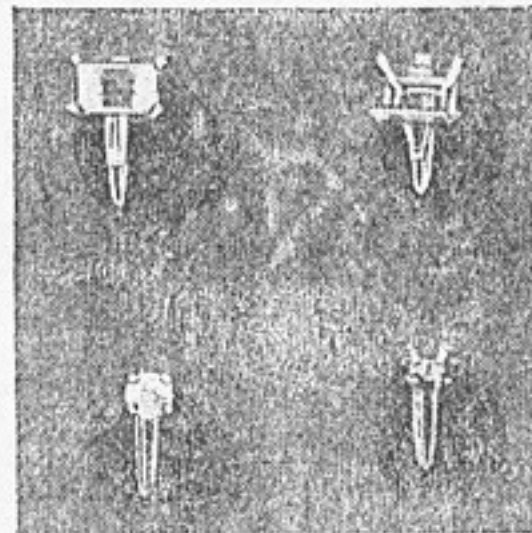
(edge) of stone lightly on a carborundum wheel, or, with a flat engraving tool remove some metal from inside of bezel.

The bezel bearing setting differs from the box setting in that bezel is not soldered to a flat piece of metal but contains a piece of metal strip soldered on the inside (Fig. 4E and F) to form a bearing for the stone. Make bezel the same way as the box setting was made. Then form a band from another piece of metal so that it fits inside bezel. File one side of band until it is perfectly flat. Now fit it into bezel to form a bearing for the stone. Place it far enough from top of bezel to allow enough metal to set the stone. Solder band to bezel and then file the bottom smooth. Stone is set in the same way as it was in the bezel box setting.

Twisted wire is often soldered around a bezel setting (Fig. 4G). The trick to fitting wire is: first, solder wire to form a band a little smaller than required; taper top edge of bezel slightly with a file; then stretch band, force it over the bezel, and push it to its proper position; finally solder twisted wire to bezel.

Simple Prong Setting

This setting is exceptionally easy to make, yet very practical. It is often used in gold and silver link bracelets, pins, and earrings. Occasionally it is used in platinum jewelry for settings for small diamonds. Though the cabochon cut stone is especially adapted for its use, it is often used with the other cut stones. There are several ways of making setting and soldering prongs. In one method, bearing or base piece is made from rectangular wire or from tubing. Wire is bent with pliers, cut to size, and soldered to form bands to match shape of stone. Sections may be



Rings with emerald (above) and Tiffany (below) settings.

cut from tubing with a jeweler's saw to form bands for round stones. In either case, band should be slightly smaller than base or girdle of stone so that when stone rests on it, it can't be seen when looking straight down. Placement, number, and size of prongs is determined by size and shape of stone. Generally four prongs are used. The prongs are made from round, rectangular, or half round wire, and shape of wire is determined by relationship of setting to the design of the jewelry. Cut prongs a little longer than required. Place bearings or base on a smooth charcoal block (Fig. 5). With pliers, force prongs against side of base and slightly into the charcoal. Prongs now can be easily soldered to base. Many

craftsmen prefer to solder one prong to the base first. This prong keeps base from moving when the other prongs are placed in their proper position. When soldering is completed, setting is removed from charcoal block, bottom ends are nipped off, bottom is then rubbed smooth on a flat emery stone, and finally, prongs are cut and filed to proper height to complete the setting.

When many identical, simple prong settings must be made, there is a trick way of making them much faster than the above method (Fig. 6). Bearing or base pieces are made from wire or tubing, though usually tubing, the same way as they are made above. Prongs are made from two wires of proper thickness and shape. Each wire is bent in the center to form a long U. Inner width of U should be the same as outer width of band. Cross both U's at the bottom, solder them together, and adjust prongs so that they are equal distances apart. Place one of the bases in position between the prongs and then solder. Repeat the operation, leaving just enough space between bases for proper height of prongs. When all bands have been soldered, wires are nipped to form individual, simple prong settings.

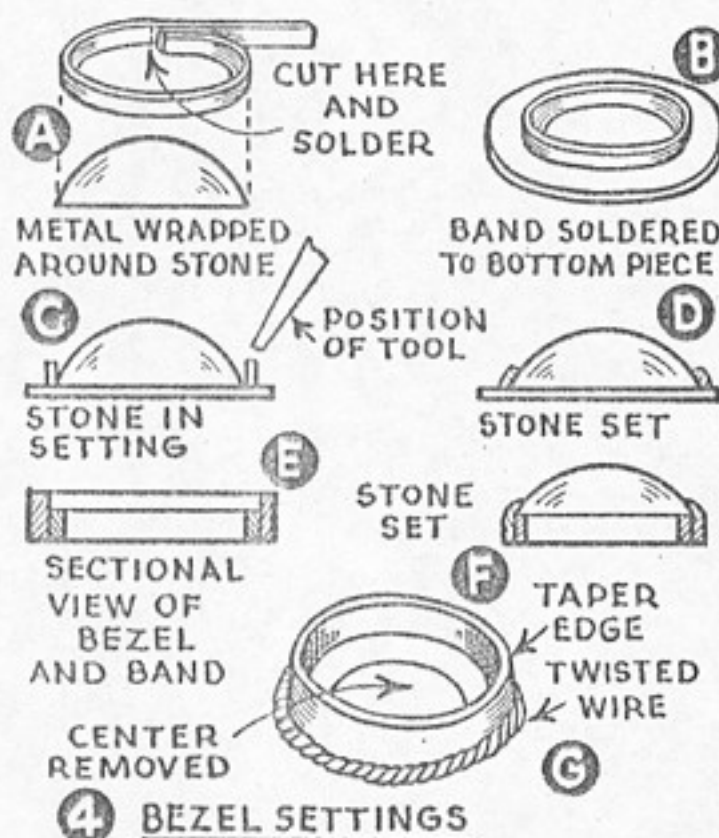
Stones are set in simple prong settings by merely pushing prongs in and down on the stone with a pushing tool and occasionally by hammering lightly on a setting tool (Fig. 2).

Prong Cluster Setting

The extremely attractive, prong cluster setting is especially suited for round, faceted rubies and sapphires. The cluster is often used in the center of modern pins and earrings. To make a seven stone cluster (Fig. 7), first cut a circle to required size and then dome it up slightly to form the base piece. Prongs are made from round wire and cut a little longer than required. Prongs for the center stone are placed first as follows: In center of base piece, with a pencil, draw a circle the same size as girdle of stone. Mark off positions for the six prongs. Prongs are spaced equally and placed approximately $\frac{1}{3}$ the thickness of the wire inside the circle. Center punch prong positions with an engraving tool, and then drill holes, the same size as the prong wire, right through the base piece. Place prong wires right through the holes so that they protrude slightly. Now solder prongs, from the back side, to base with a high melting solder.

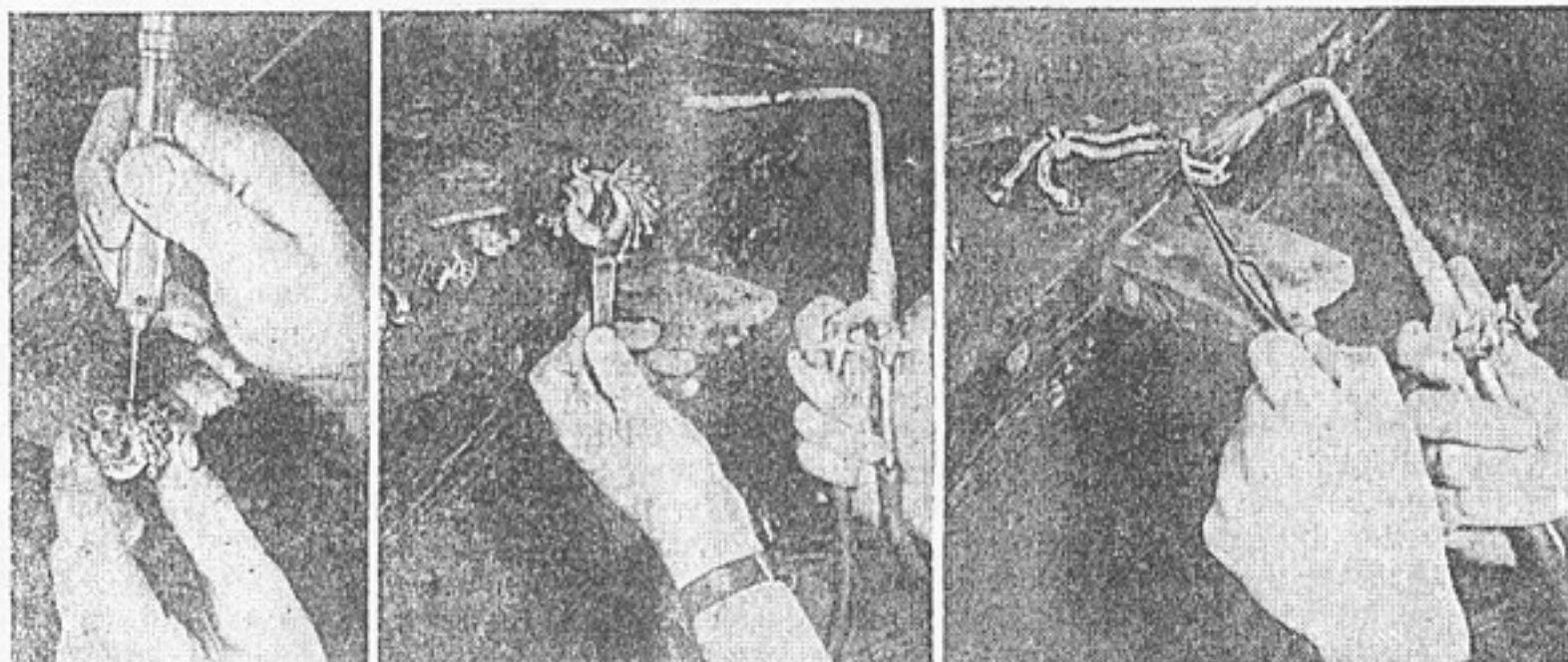
Repeat this operation for the other stones. Note that only four prongs (some craftsmen use six) are required for these stones. After all prongs have been soldered into position, parts that protrude through back of base are ground flush. Holes, as large as possible, are now drilled between prongs where stones are to fit. Finally, outer edge of base piece is filed smaller until it touches prongs to complete the setting. There are many other versions of the prong

cluster setting that may be worked out. The same procedure may be used for rectangular and square shaped clusters. Stones are set in prong cluster by cutting a bearing on the prongs for the stones with a frazer. Center stone is set first by hammering or pushing prongs in and down upon it. Then the other stones are set. Prongs are often rounded off using a cup frazer.

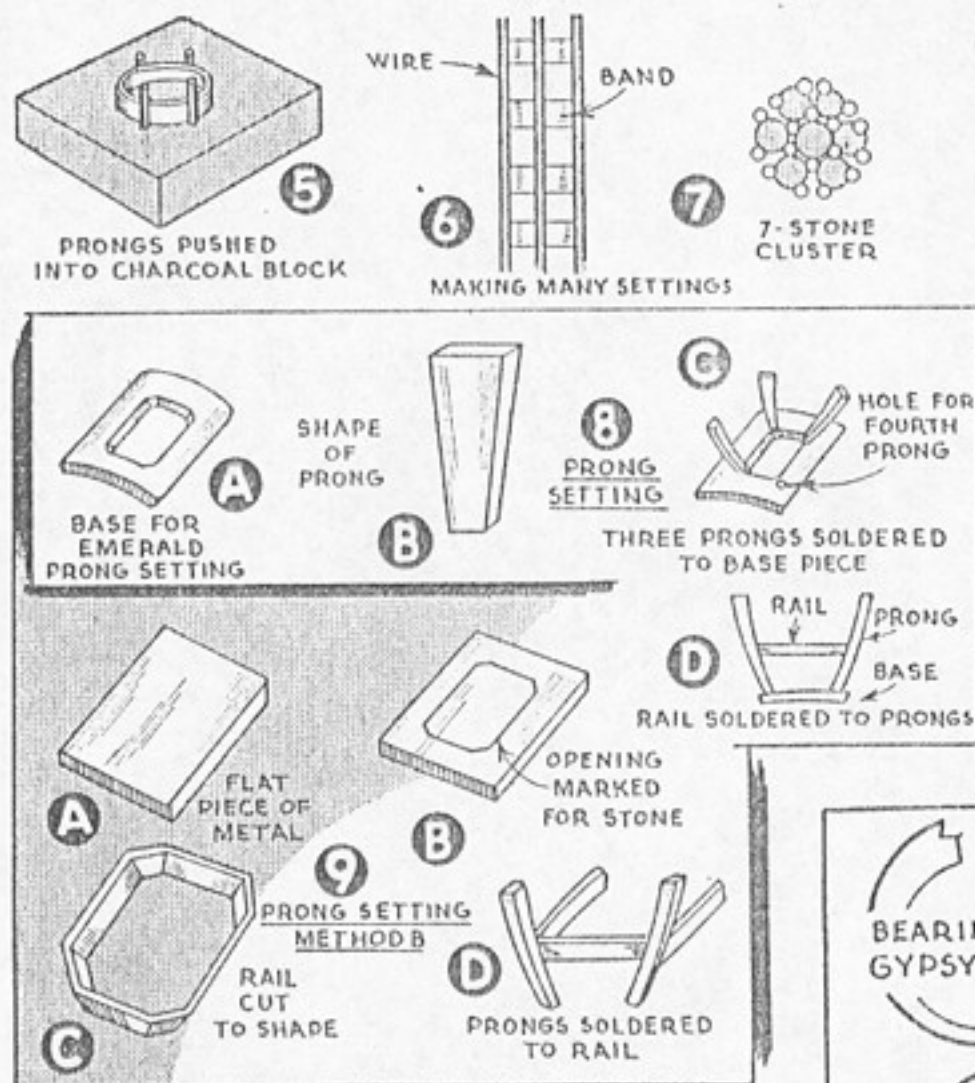


Emerald Cut Prong Setting

One of the most beautiful of all settings, the emerald cut prong setting, is made by hand for the most expensive gold jewelry and for models. The method that the individual craftsman may use to make this setting depends on his background and training. In all methods, setting is made to fit stone.



Left, using flexible shaft and frazer on cluster setting. Center, soldering settings to main body of jewelry. Right, method of holding setting when soldering rail to prongs.



To use *Method A*, make the base of the setting first by carving a comparatively thick piece of metal on a lead or steel block until it matches the ring size curvature (Fig. 8A). Now cut an opening in center of base the same size and shape as the rectangle formed by the bottom facets of the stone. When cutting out metal with the jeweler's saw, hold saw at the same angle as the slope of the stone so that stone will fit into formed opening perfectly. File the opening wherever necessary. Prongs are made from a rectangular piece of metal and they are cut a little longer than required. Now file them on the wide sides in order to taper them properly (Fig. 8B). Bottom of prong now should be square. Using a drill a little smaller than the bottom of prong, and holding drill at the same angle as the slant of the small octagonal side of the stone, drill through metal as close as possible to opening in base piece. Taper holes to same taper as the prongs with a frazer. Force prongs into holes with the aid of a plier and then, from the back, solder prongs (using the highest possible melting point) to the base (Fig. 8C). Now curve and adjust prongs to fit stone perfectly.

Next make the horizontal rails from a rectangular piece of metal that is slightly thinner than the prongs. Cut and file rails to fit between the prongs perfectly and then solder them in position with a high melting solder (see photo and Fig. 8D). Rails are placed just below the first horizontal plane formed by facets below girdle of the stone, so that they can't be seen when look-

ing directly down on the stone. A little filing is all that is now required to finish the setting. After setting has been soldered in position, and the jewelry object completed, the stone is set. Each prong is notched with a triangular file to form a bearing. The prongs are then pushed and if necessary hammered to set the stone.

Method B is preferred by many jewelers. Here the rail is first made from a piece of flat metal by marking off proper opening to match rectangle of stone at the first horizontal plane below the girdle (Fig. 9A and B). Corners are marked to match small octagonal corners of stone. Opening is cut out with the jeweler's saw which is held at same angle as slope of stone. Opening is then filed

so that stone fits into it perfectly. Next, proper thickness of rail is marked off with a divider and metal is cut along this line with the jeweler's saw, inclined at the same angle as the opening. Frame that is formed becomes rail of setting (Fig. 9C). Outside is filed and wall is reduced in the corners where prongs are to fit. Prongs are formed from a rectangular piece of metal and filed as in *Method A*. Prongs are then soldered to frame with a very high melting

solder (Fig. 9D). A piece of metal is curved to form the base, and prongs are cut and filed to proper height and then soldered to base. Opening is then cut in base and finally the outside of base is cut to shape to complete the setting.

Method C is often used by platinum workers. A rectangular wire is bent to shape around the stone at the first horizontal plane below the girdle, to form a band which eventually will become the rail of the setting. Prongs are then forged from square wire by hammering one-half of the wire until it tapers and then by repeating the process on the other side on the opposite end. Prongs are then filed smooth. Next, one corner of the band is notched out with the jeweler's saw just large enough for a prong. A prong is then fitted, adjusted, and soldered or welded into position. This operation is repeated for the other prongs. Prongs are then soldered to the base piece as they were in *Method B*. Settings for large round diamonds in platinum are often made by *Method C*. The band is bent to form a circle and the base piece is often left longer to form a good part of the ring shank.

Gypsy Setting

The gypsy setting is a popular setting for cast rings and it is especially good for cabochon cut stones. Figure 10 shows a sectional view of a cast ring. A bearing is cut into the tapered opening for the stone. The opening is usually made by means of a core when it is cast; however, it may be cut into the ring with a jeweler's saw. Bearing is cut with a diamond and flat engraving tool. Stone is set by hammering on a flat setting tool until the metal is pushed firmly

against the stone.

Other settings such as the fishtail, channel, and calibre, can be made after a little study by using the material in this article. The settings for round small diamonds are usually formed by first drilling holes through the metal, usually platinum, where stones are to fit. Holes are then enlarged by means of a tapered frazer until girdle of stone is just slightly below surface of metal. Stones are then set by hammering or by round heads formed by an engraving tool.

MODERN MECHANICS July, 1935

TOY WINDMILL Operates Comic FIGURES

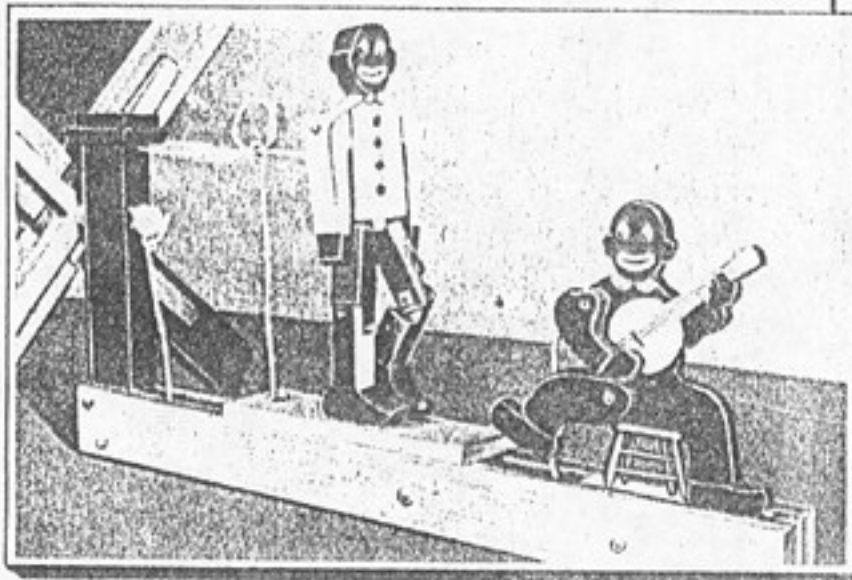
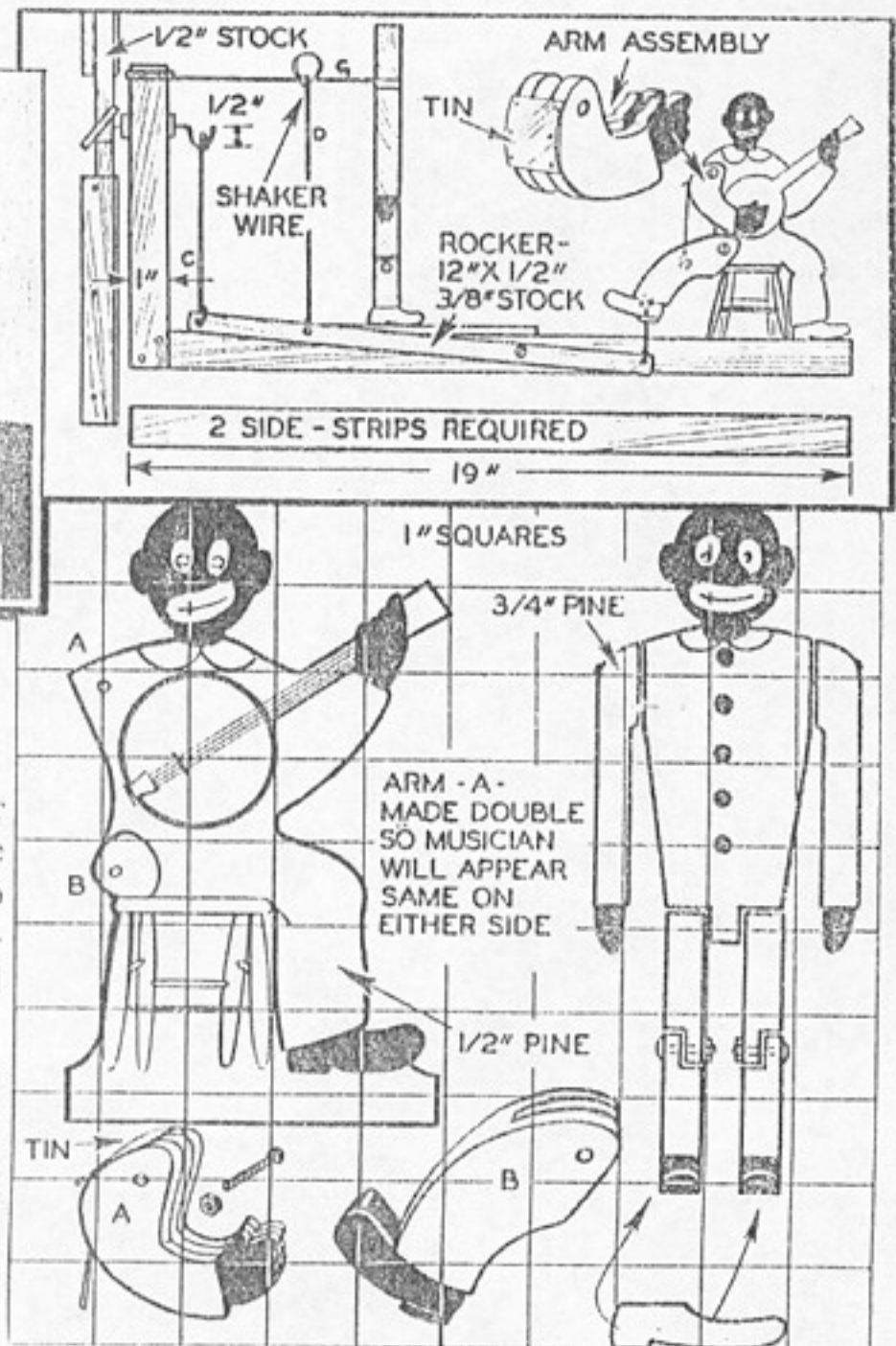


Photo above shows unique windmill toy which anyone can make. Diagram at right reveals manner of laying out and assembling parts. As windmill spins, limbs, connected to rocker arm, move in a life-like manner.



ANIMATED toy windmills are popular subjects. In the one shown above, the spinning windmill causes the tiny figures to dance and play. Despite its complicated action, the toy is really easy to make and will provide much amusement.

The 16-in. sails are made of cigar box wood, nailed to $\frac{1}{2}$ -in. arms. The blades spin on a wire axle which passes through the center of the propeller and upright standard. Hooked at one end, the axle is fastened to a 12-in. rocker, which controls the limb movements of the tiny figures by its up and down action. The wire connectors are cut from telephone wire and must be of the proper length to insure smooth action. Movement of the shaker wire causes the upright figure to dance while the banjo-strumming "darkie" taps his foot.

When completed, enamel the device with gay colors. Hands, feet and faces of the

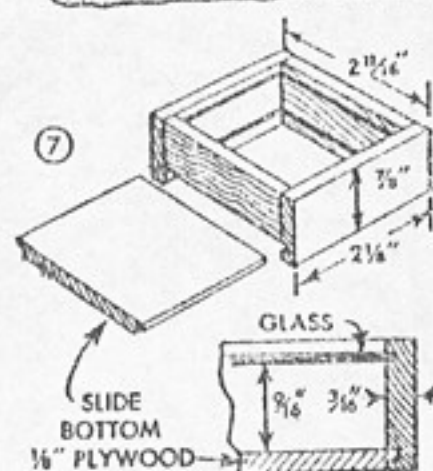
figures should be painted black, with white eyes and pink lips. Mount on rigid support where breeze will strike it.

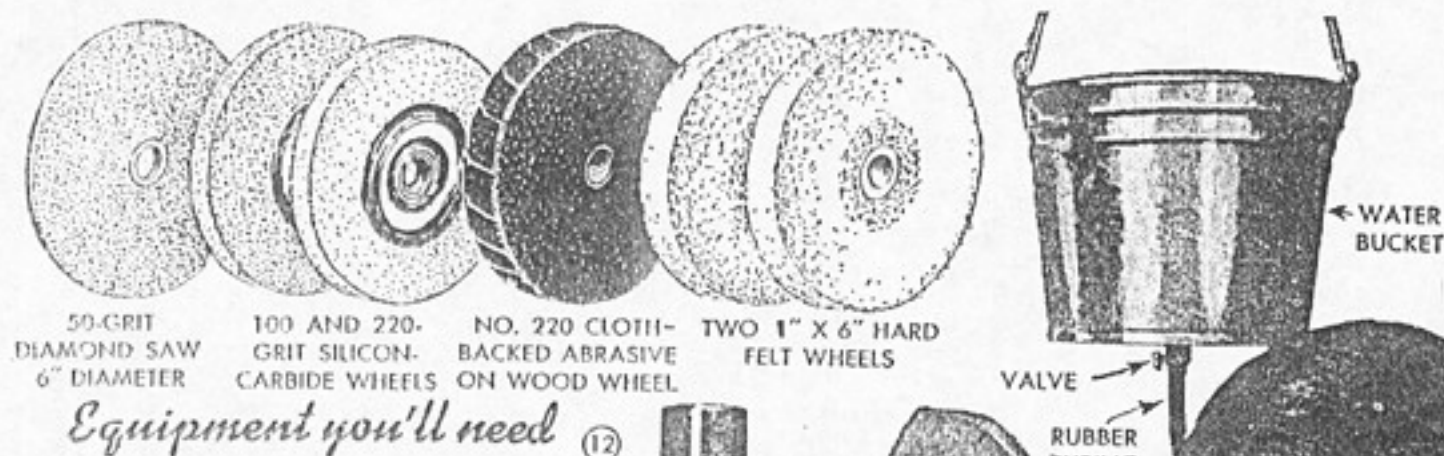


IF YOU are looking for a new hobby, try mineral collecting. You can go at it in one of two ways. You can merely collect minerals or you can collect and then cut and polish those rated as semi-precious gems. Stones are available at nominal cost, but it is more fun prospecting for your own. Almost any beach or river bed will yield stones suitable for cutting.

The gem cabinet: Like any other hobby, gem collecting is most enjoyable when you can display your work. A small cabinet for this purpose is pictured in Figs. 1 and 2, and is detailed in Fig. 3. The hinged lid carries a white bulb and a black bulb, the latter for viewing fluorescent minerals. Two sliding trays in the upper part of the cabinet provide room for 16 individual gem mounts. The top drawer has a tray and 36 compartments. The second, third and fourth drawers have 16 compartments each for larger specimens, and the large bottom drawer is plain. However, the arrangement can be altered to suit, but this plan will be found very satisfactory, as it provides accommodations for 150 to 200 specimens.

Individual mounts: Cut and polished stones look best in individual mounts and should be mounted on white cards together with a small piece of the raw material if available. A good type of mount is shown in Figs. 5 and 7. The slide bottom permits ready removal of the stone. Rubber cement is used to mount the stone on a white card, which then is pushed up from the underside of the mount until it is tight against



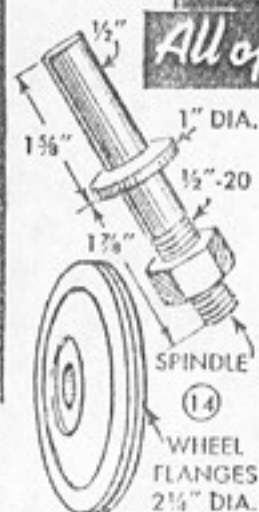


the glass. Corrugated cardboard is used as a filler. Two very simple mounts are shown in Fig. 8. One of these is a cigarette box with the top cut out and covered with black gummed tape after the stone is mounted; the second is an ordinary penny matchbox treated in a similar manner.

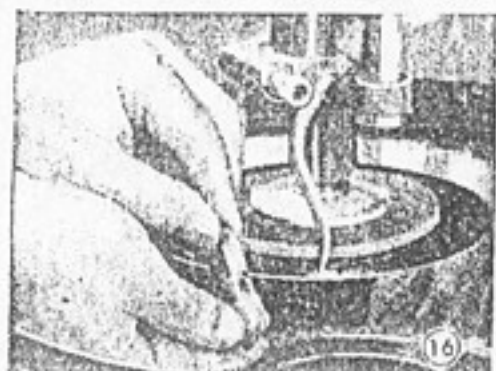
Minerals: Start your collection by purchasing two or three ordinary mineral assortments. Some of these are already boxed, Fig. 4, and can be obtained for as little as one dollar for 24 specimens. These usually are not cutting material, but are colorful and a worthwhile



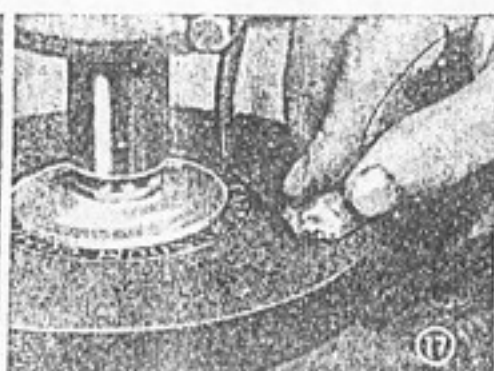
1—Break large stone into small pieces. Further trimming can often be done by pinching off the pieces with a pair of pliers



part of your collection. You will certainly want a set of eight or 10 fluorescent minerals. These are just ordinary stones when viewed under ordinary light, but under the black bulb they glow in brilliant colors. Likely, you will want a set of minerals illustrating Mohs' scale of hardness, Fig. 9. Then there are many unusual minerals that add considerable interest to any collection: natural stone crosses and beautiful masses of rock quartz crystals; lodestone



2—If diamond saw is available, trim stone by sawing. Use plenty of water. Hold stone steady. Speed 2400 r.p.m.



3—Grind base of stone flat on 100-grit wheel. Use plenty of water. Speed 1200-2400. Repeat operation on 220 wheel



4—Mark outline of stone, using pointed piece of aluminum

MOHS' HARDNESS SCALE		
No.	Mineral	Comparative Mat'l
1	Talc	Lead - 1½
2	Gypsum	Fingernail
3	Calcite	Copper coin
4	Fluorite	Iron - 4.5
5	Apatite	Knife blade
6	Feldspar	File - 6.7
7	Quartz	Garnet
8	Topaz	Steel - 5.8½
9	Corundum	Silicon carbide - 9½
10	Diamond	

ROUGH—BY THE PIECE
OR POUNDSLICED—USUALLY
¼" THICKREADY-CUT—STONES
ROUGH-GROUND TO SHAPE

Buy gem material any of three ways

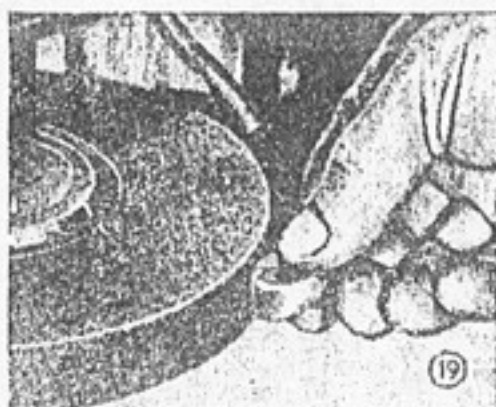
(11) SELECTED CABOCHON CUTTING GEM MATERIALS

Name of Mineral	Hard- ness 1	Spec. gravity	Color 2	Transparency and luster 3	Cost 4	Remarks
Agate, banded	7	2.7	Usually red brown and white in bands	Translucent glassy luster	Low	Best known agate. Usually very attractive coloring
Agate, moss	7	2.7	Red, green or gray	Translucent glassy to waxy	Low	Shows moss growth in interesting patterns
Agate, scenic	7	2.7	All colors	Translucent glassy	Low to med.	Inclusions resemble flowers, trees, etc.
Agate, Sweetwater	7	2.7	Gray, with dark inclusions	Translucent waxy	Low	Sweetwater, Wyo. A moss agate—water worn pebbles
Amazonite	6½	2.5	Green, lightly streaked with white	Opaque glassy	Med.	Variety of feldspar. Nice color
Azurite	3½	3.7	Deep blue	Opaque waxy	Med.	Too soft for rings. Tends to undercut
Chlorastrolite	5½	3.2	Green with white markings	Translucent to opaque-glassy	High to v. high	Water worn pebbles. Often chatoyant 5
Chrysocolla	3	2.2	Green or green-blue	Translucent to opaque-glassy	Med.	Rather soft. Very nice blue color
Dinosaur bone	7	2.6	Usually red, brown or black	Usually opaque waxy	Low	Bone replaced by agate or jasper. Often nicely marked
Jade, American	6½	3.1	White to green	Translucent glassy	Med. to high	Oregon (grossularite). California (vesuvianite). Good cutting
Jasper, breccia	7	2.6	Mixture of various colors	Opaque waxy	Low	Attractive coloring. Also "puddingstone"
Jasper, poppy	7	2.6	Usually red with yellow markings	Opaque waxy	Low	Attractive coloring. Also known as orbicular jasper
Labradorite	6	2.5	Gray, with blue play of color	Opaque glassy	Med.	Excellent play of blue color. Labrador, Canada 6
Lapis lazuli	5½	2.6	Deep blue or green-blue	Opaque to translucent-glassy	High	Cheap specimens usually in gray matrix 7
Malachite	3½	3.8	Bright green	Opaque glassy	Med. to high	Often banded or with radial fibrous structure
Moonstone	6½	2.6	Translucent white	Translucent glassy	Med.	Usually double cut to display marked opalescence 8
Opal	5½	2.0	Various. Usually white or black	Translucent glassy	High to v. high	Precious varieties show beautiful play of colors 6
Petrified wood	7	2.7	All colors	Translucent waxy to glassy	Low	Also agatized wood. Interesting patterns, nice colors
Rose quartz	7	2.6	Pink	Translucent glassy	Med.	Often opalescent. Valuable when asteriated 9
Sagenite	7	2.6	Red-brown hairs in clear quartz	Transparent glassy	Med.	Also rutilated quartz or Venus's-hairstone
Smithsonite	5	4.2	Green or blue	Translucent glassy	High	Nice color. Green variety also known as benonite
Tiger-eye	7	2.6	Yellow-brown, sometimes red or blue	Opaque glassy	Med.	Chatoyant. Principal locality, South Africa 5
Thomsonite	5	2.3	White, gray, red or brown	Transparent to opaque-glassy	High	Popular with mottled or eye markings in red or green
Turquoise	6	2.6	Green to sky blue	Opaque waxy	High	Sky blue color is most desirable
Variscite	4½	2.5	Apple green to blue-green	Translucent to opaque-glassy	Med. to high	Cheap specimens in slate gray matrix 7

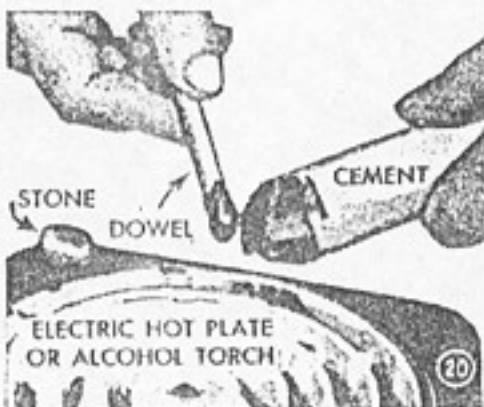
NOTES

1. Based on the ability of one mineral to scratch another. See Mohs' scale above. No. 7 will scratch No. 6, etc.
2. Some variation in color should be expected.
3. Glassy indicates luster of glass; Waxy, somewhat lower.
4. Most gems listed are inexpensive. Low indicates 2 oz. for 25 cents, from which you can cut three or four ring-size cabochons. Medium, 1 oz.; High, ¼ to ½ oz.; Very high, less than ¼ oz. for 25 cents.

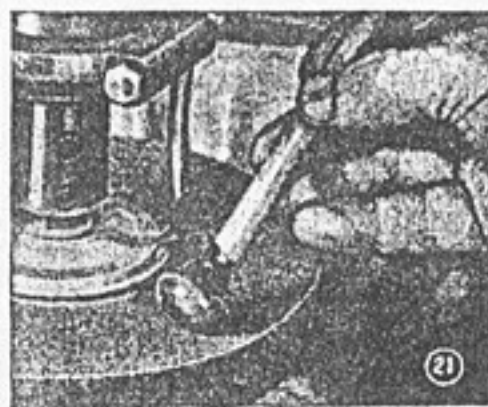
5. Chatoyant—a rippling play of light on the surface of the stone. Same effect often seen in wood.
6. Play of color—a changing play of color on the surface or interior of stone. Most pronounced in opal, which shows flashes of red, blue, green and other colors.
7. Matrix—the slate, shale or other material in which some gems are found. Sometimes attractive, usually not.
8. Opalescence—a play of light without color inside the stone. Most pronounced in moonstone.
9. Asteriated—showing starlike light when viewed under good light. Star rubies and sapphires are best examples.



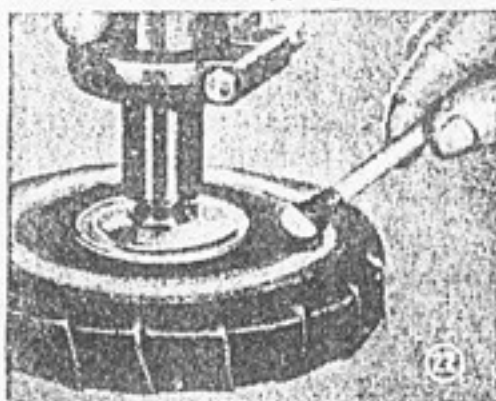
5—Grind outline and shape roughly on 100-grit wheel. Use plenty of water. Speed 1200-2400. Watch out for chipping (see text)



6—Cement the stone to a dowel stick. Use regular lapidary cement. Both stone and cement must be hot for good adhesion



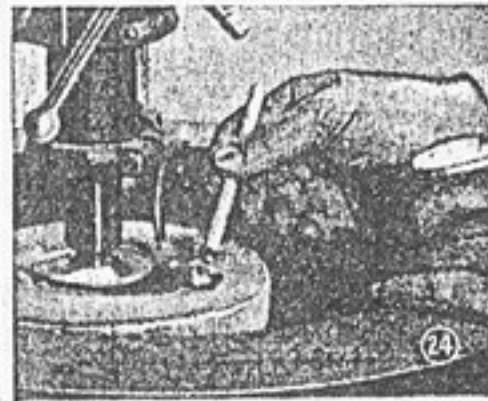
7—Further smooth the stone, using 100 and 220-grit wheels in succession. Keep wheel wet to avoid burning. Speed 1200-2400



8—Dry-sand on 220-grit cloth backed with felt on wood wheel. Speed 1200. Use moderate pressure, but avoid getting stone hot



9—Mix polishing abrasives with clay flour and water to form a paste. Use F-grit silicon carbide for first polish; tripoli for final



10—Polish on felt wheels. Keep wheel wet with tiny trickle of water. Speed 1200. Use moderate to heavy pressure (see text)

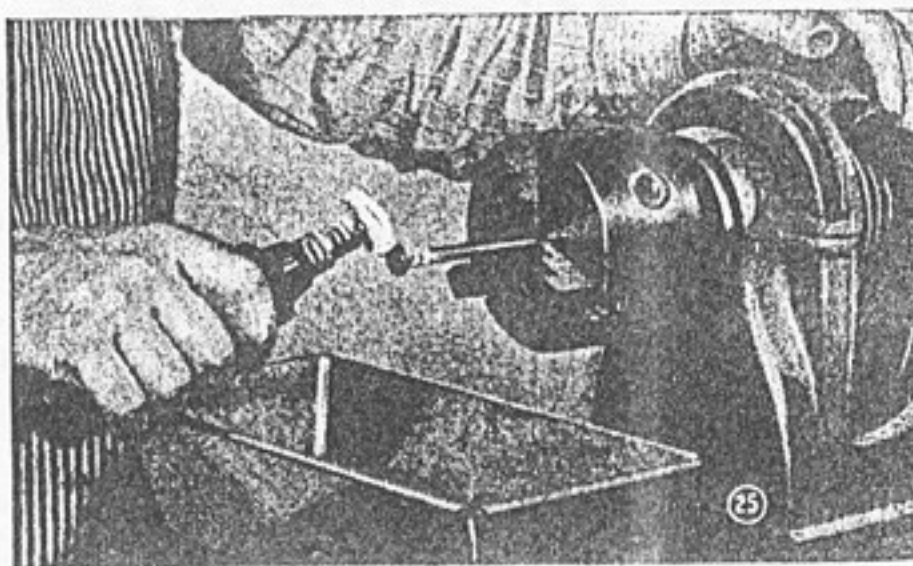
(magnetite), which is strongly magnetic; Iceland spar, which shows two images of anything viewed through it; selenite, which can be bent without breaking.

Cutting materials: Minerals suitable for cutting because of their color or sparkle are called gem stones. A selected list of cutting materials is given in Fig. 11; most of these are inexpensive and readily obtainable. These stones are intended for cutting en cabochon. Cabochon gems usually are round or oval, but may be almost any shape, Fig. 6, so long as they are not facet-cut like diamonds or other transparent stones. Cutting material includes all minerals which look attractive when cut and polished; you can pick up pebbles from any beach that will rate as semi-precious gem stones. Most popular with beginners are agate, petrified wood, tiger-eye and jasper. All of these except tiger-eye occur in a wide variety of brilliant colors and markings so that a good collection can be based on these alone. The most expensive stone in the list is opal. There are cheap varieties of this—common opal—but gem quality indicates a stone which flashes red, blue and green patches of color as it is turned in the hand. A few of the stones, such as variscite, turquoise and lapis lazuli, occur in matrix; that is, the actual gem stone is embedded in a valueless mass of slate, shale or other mineral.

Sometimes the matrix polishes nicely and the whole thing makes an attractive gem stone; usually, however, the matrix is not attractive.

You can buy cutting material in three forms, as shown in Fig. 10. Rough cutting stock averages one dollar per pound; sliced material costs about 50 cents for a 3 by 3-in. slice, and ready-cut gem stones about 50 cents each. It is a good idea to experiment with all three since each has its good points in money value or workability.

Gem cutting and polishing: Complete accessory equipment for gem cutting and polishing is illustrated in Fig. 12. Of these items, the diamond saw (diamond grains embedded in the rim of a copper disk) is the most expensive, costing several dollars in the 6-in. size. The rest of the items can be purchased at a total of about five dollars. The actual gem-cutting machine can be almost any type of motor-driven spindle. One of the best spindles for this work is a drill press. If this is fitted with a simple cooling system (water), it is ideal for the various cutting and polishing operations, Fig. 13. The only other extra equipment needed is a spindle as in Fig. 14, and even this is a standard drill-press accessory (grinding or shaping arbor). The feed pan used to hold and control splash of water can be obtained from any farm store for about fifty cents.



Figs. 15 to 24 inclusive show the cutting and polishing operations. With a little experience, it takes about 40 min. from rough stone to finished gem. Make your first job an agate. Break or saw the rough stock to get pieces suitable for gem cutting. In operation 5, Fig. 19, keep a bevel ground on the stone in advance of the side cutting. If you grind right down to the outline on the 100-grit wheel, you may chip the edges. In Fig. 20, use a stick somewhat smaller than the stone. Heat the stick and cement together over a hot plate or torch. When the cement begins to melt, twist it off onto the stick. Have the stone hot before you press it into the cement—it should be just as hot as you can hold. Good adhesion usually will be obtained if both stone and cement are hot. Moisten your fingers and mold the warm cement around the bottom of the stone, but keep it clear of the edges. Let cool 10 min. or dip in cold water to set cement. Operation 8—this is done dry. The sanding cloth should be backed with something that has a slight amount of "give." Felt is standard, but a piece of carpeting or several layers of canvas will do. Use moderate pressure, but stop frequently to avoid overheating the stone. Operation 10—use heavy pressure in the rough-buffing operation with F-grit silicon carbide grains. The felt buff must be fairly hard and of the proper combination to assure smoothness. The removal of tiny flats requires a hard buff and hard pressure. Don't try buffing with a loose muslin buff—you may get a mild degree of polish but the surface will be lumpy. Have the abrasive in a dish and apply to stone every 10 seconds. Get the stone as smooth as possible with the F-grit before you change buffs for the final polish. This can be done with tripoli or any of the special buffing powders formulated especially for this work.

It is easy to tell when the stone is pol-



ished perfectly. It has a glasslike appearance, you can see your face in it, and the image of a lamp bulb or window is bright and sharp. If it does not satisfy you, go back one or two steps and try again. Never rush the polishing schedule; never say, "I can take that out in the next operation." What you can do in a few seconds by sanding takes several minutes on the buffing wheel.

Other tool setups: You can grind and cut gems on almost any kind of spindle. The lathe, the bench grinder, and buffing heads can be used. If you have a belt sander, use it with a 220-grit belt, as in Fig. 26. Round cabochons are ground readily with a lathe; cement the stone to a metal rod, then grind with a hand grinder, Fig. 25, and polish with a rag and abrasive with the lathe in motion.

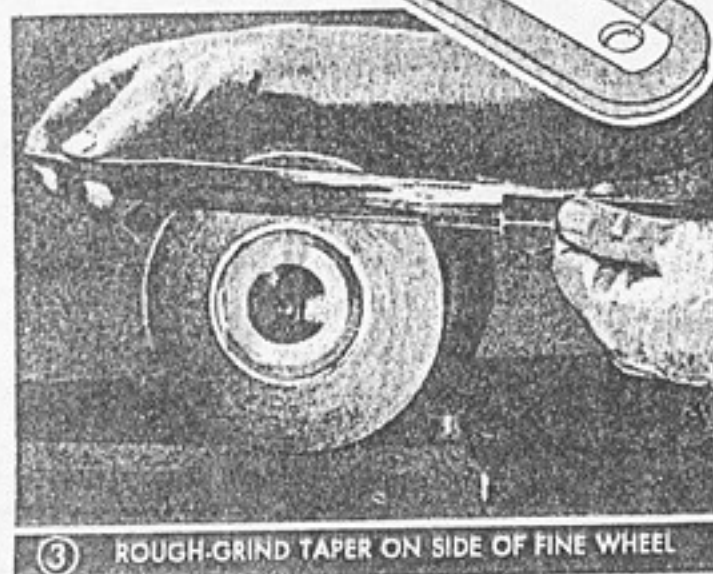


KNIVES FROM HACKSAW BLADES

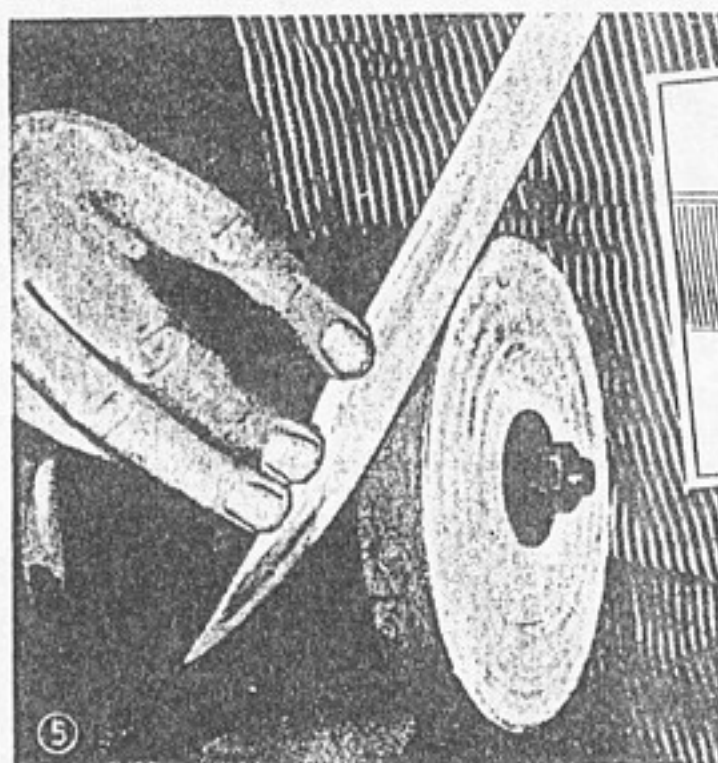


WELL tempered, razor-sharp knives that keep their keen edge can be ground from worn or broken power-hacksaw blades, obtainable at many machine shops. As these blades are made of hard steel alloy such as molybdenum, which is so tough that a file will not cut it, shaping the blades must be done on a wet grindstone or very lightly on an emery wheel. Heavy pressure results in overheating and withdrawing the temper from the steel, which renders the blade useless. When grinding, a blade should be dipped in warm water every half minute or so, but if it is hot enough to sizzle, allow it to cool in the air. Tempered steel should never be immersed in cold water while the metal is hot.

When grinding knives from hacksaw blades, the best procedure is to work on two or three blades at once. As soon as one becomes too warm for the fingers, lay it aside and work on the next. The carving-knife blade shown in Fig. 1, utilizes an entire hacksaw blade. Broken blades are used for shorter knives. Before you start grinding, the shape of the knife is outlined on the blade with a wax crayon, and a full-size pattern on paper should be made for checking. A fairly coarse wheel is used to blank the knife to shape.



Rough-grinding the tempered sides to remove excess material, which is a slow process, is done on the side of a fine wheel as shown in Fig. 3. As the blank gets thinner it tends to heat more rapidly and therefore it is necessary to take light cuts the entire length of the blade. Be sure to keep the blade moving rapidly, not letting it come to rest for an instant. First work on one side and then on the other to cut the two sides down evenly. Smoothing of the

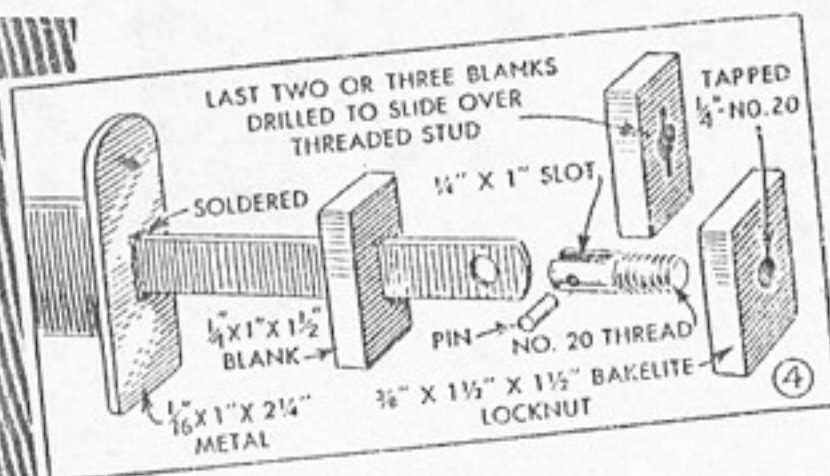


⑤ USE "GREASE WHEEL" TO REMOVE GRINDING MARKS



⑥ WORK HANDLE TO SHAPE ON SANDING DRUM

blade to eliminate grinding marks is done on an abrasive-coated cloth wheel, often referred to as a "grease" wheel because it is smeared with tallow. Such a wheel consists of a number of muslin buffs glued together after which the edge is treated with glue and rolled in emery powder. No. 120 powder will be suitable for the dressing operation. When dry, the wheel is smeared with tallow and is loaded with powdered pumice stone. Then the blade is pressed firmly against the wheel, dragging it the entire length on the wheel as shown in Fig. 5, the wheel rotating away from the edge of the knife. Avoid light pressure as it results in



chatter marks that are very difficult to remove. Usually five or six firm strokes are sufficient to produce a smooth surface.

From now on extreme caution must be exercised as the blade has become dangerously sharp. Slippery with grease, it can inflict severe injury if it gets out of control. Working the smooth surface of the blade down to a silvery sheen is done on a cutlery bob shown in Fig. 7. It is turned from hard maple, then treated with glue and rolled in very fine emery powder or silicon-carbide flour. No. 2F flour will produce a nice luster but for an extra-fine finish, make a second bob and coat it with No. 500 silicon-carbide flour. In doing this, use tallow and firm pressure, keeping the blade in constant motion. The knife edge will now be very sharp but will be "feathered," and will not stand up under any practical use. A slip stone rubbed lightly along the shoulders will alter the bevel of the edge to a point where the mechanical strength is sufficient to support the thrust, the bevel being determined by the work for which the knife is to be used. Bevel A in Fig. 2 is best for cutting raw meat where bone may be encountered; B for cooked meat, fowl, etc., and C for boneless meat, vegetables, etc. When dull, sharpen on the 500 bob, well-greased, and finish with a fine slip stone.

⑦ CUTLERY BOB

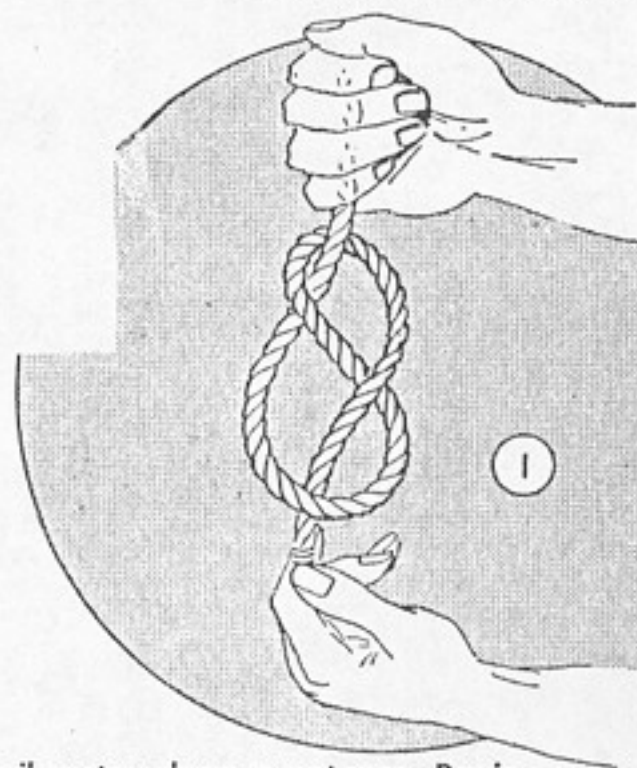
1 1/2 x 2 1/2" HARD-MAPLE WHEEL COATED WITH EMERY GRITS



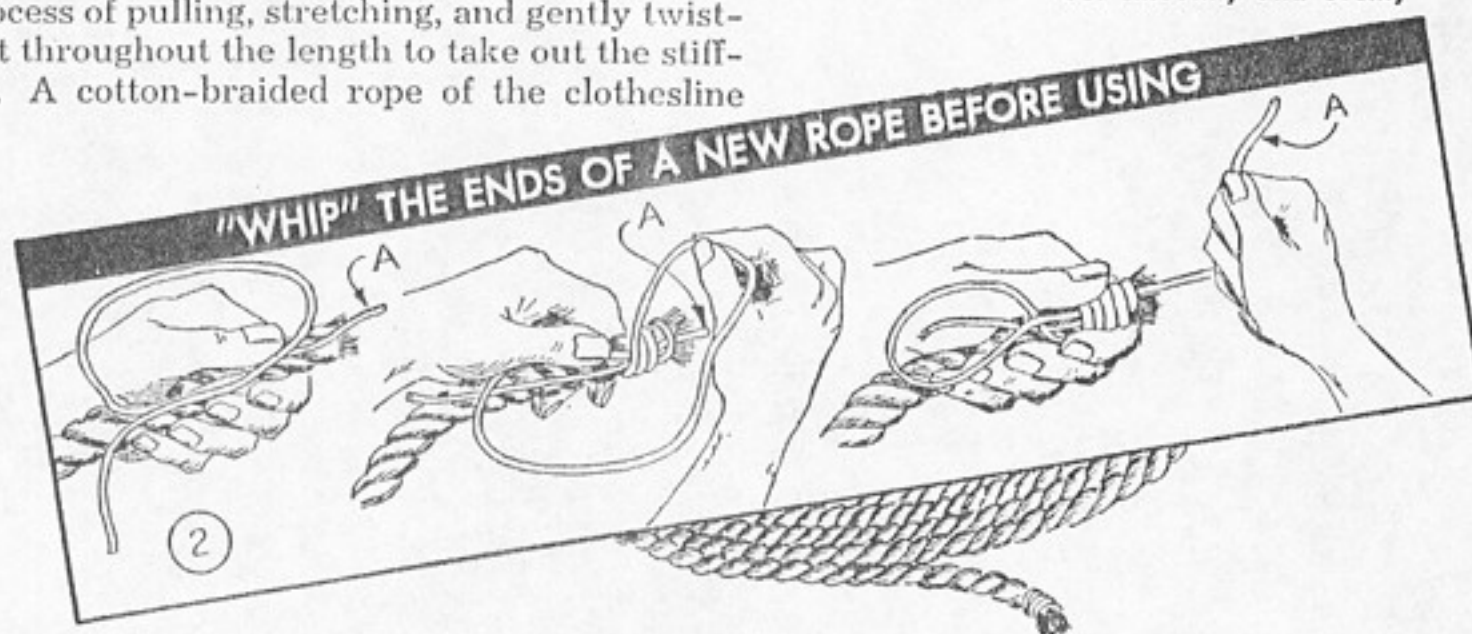
⑧ FINISH BY DRESSING WITH FINE FILE

It's Easy To Tie KNOTS

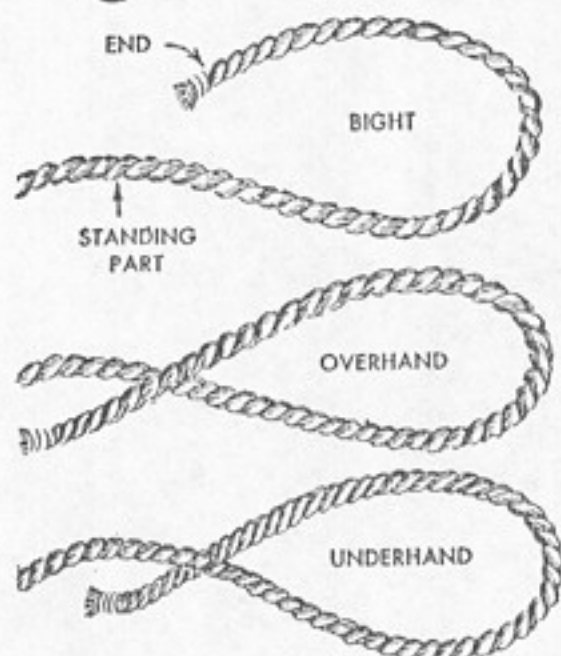
ALTHOUGH a piece of rope or cord has no separate parts such as top, bottom, or sides, in knot tying one has to think of a length of rope or cord as having three sections. These are the two ends and the standing part, Fig. 3. No matter how complicated the knot it consists basically of three turns, the bight, and the overhand and underhand loops. Certain knots are formed on the ends of separate ropes, others are tied on the standing part alone and some are tied with the end and the standing part. Knots also are formed with the separate end strands of a rope. Skilled users always "work" a new rope before putting it in service. "Working" a rope is simply a process of pulling, stretching, and gently twisting it throughout the length to take out the stiffness. A cotton-braided rope of the clothesline



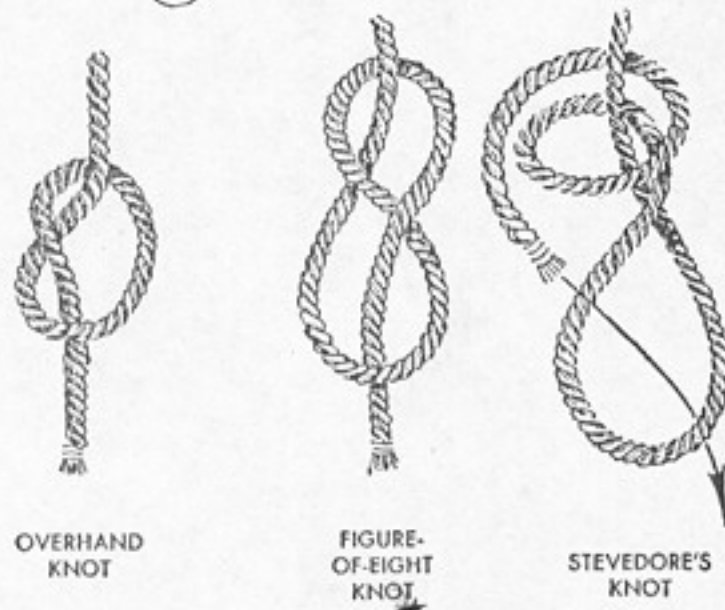
Do not coil or store damp or wet rope. Dry in the sun and then coil and store in a dry place. Rope that is not to be used for some time should never be allowed to tangle and kink. Always coil it when dry so that it will pay out smoothly and evenly



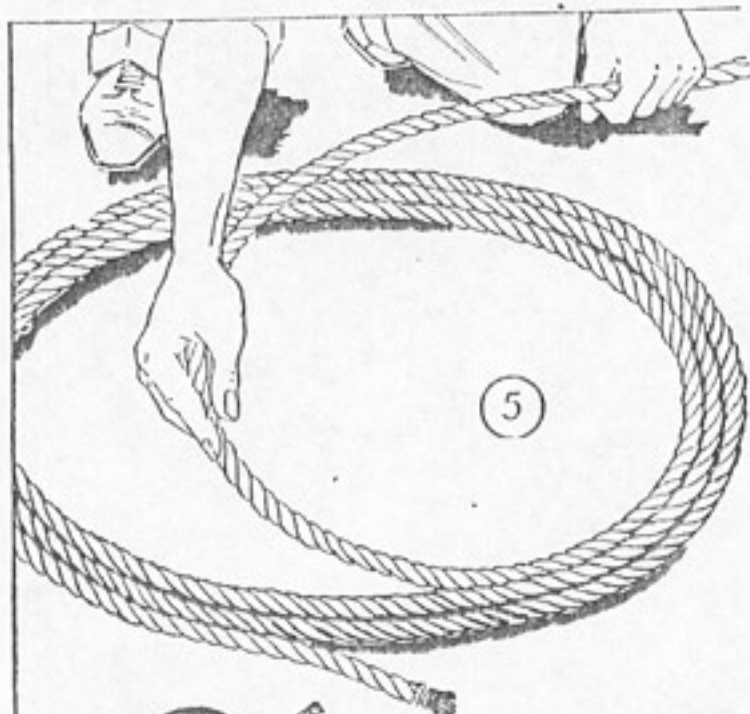
③ ROPE SECTIONS



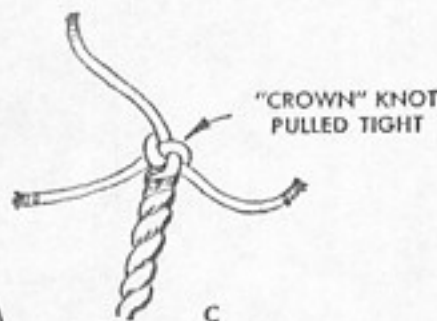
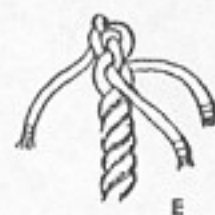
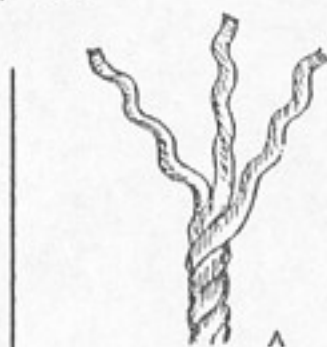
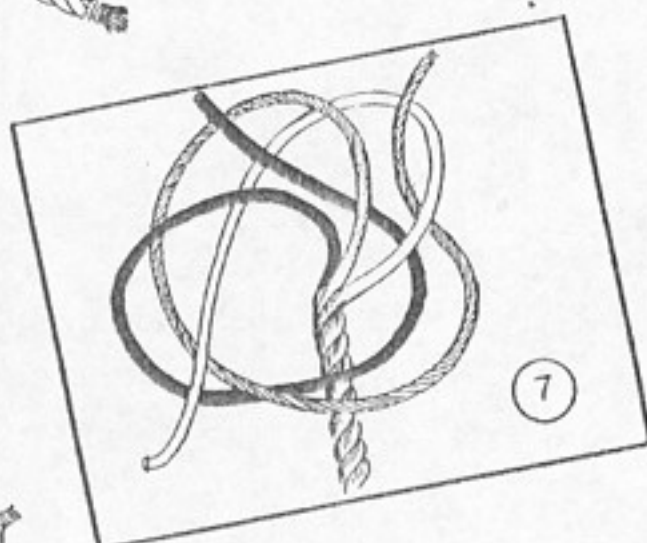
④ END KNOTS



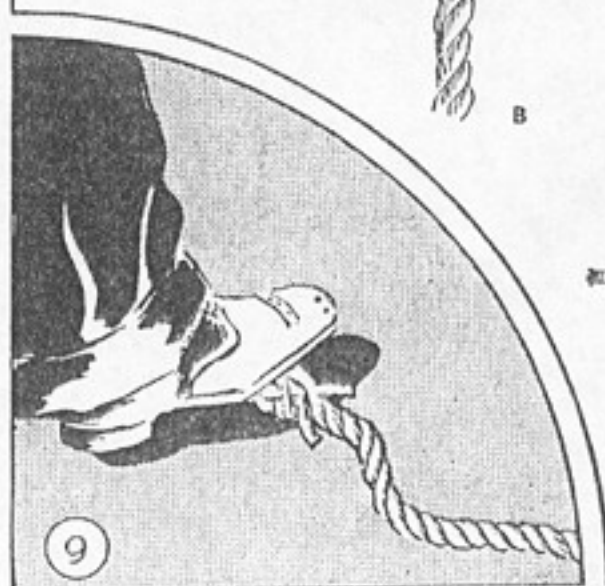
FLAT COIL, LONG COIL AND BACK SPLICE



6 WALL KNOT



FINISH



variety will quickly become soft and pliable in ordinary use, too soft for most rope work, but a hard-laid manila-fiber rope is not suitable for use until it has been thoroughly worked.

To practice tying knots it is somewhat handier to use a three-strand rope $\frac{3}{8}$ in. in diameter and fifteen to twenty-five feet long. Work it well to take out the newness and stiffness then stretch it tight and run a piece of coarse cloth several times over the length of it. This will pick up the fine "slivers" of fiber which project from the surface of the strands. This will prevent any injury to your hands while gripping the rope tightly as is necessary in tying certain of the various knots. Although most of the knots detailed are shown tied with rope it should be remembered that most of them are just as effective when tied in any cord or twine of small diameter.

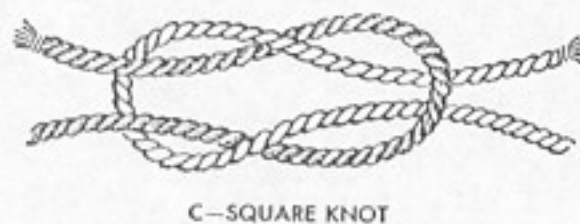
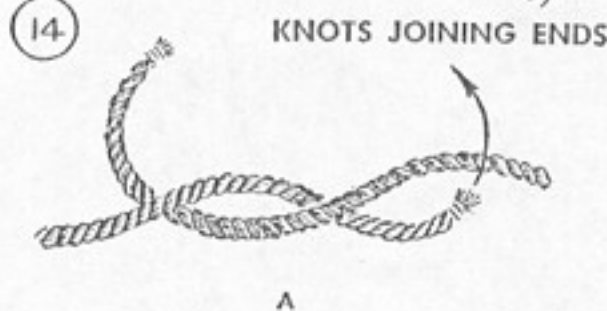
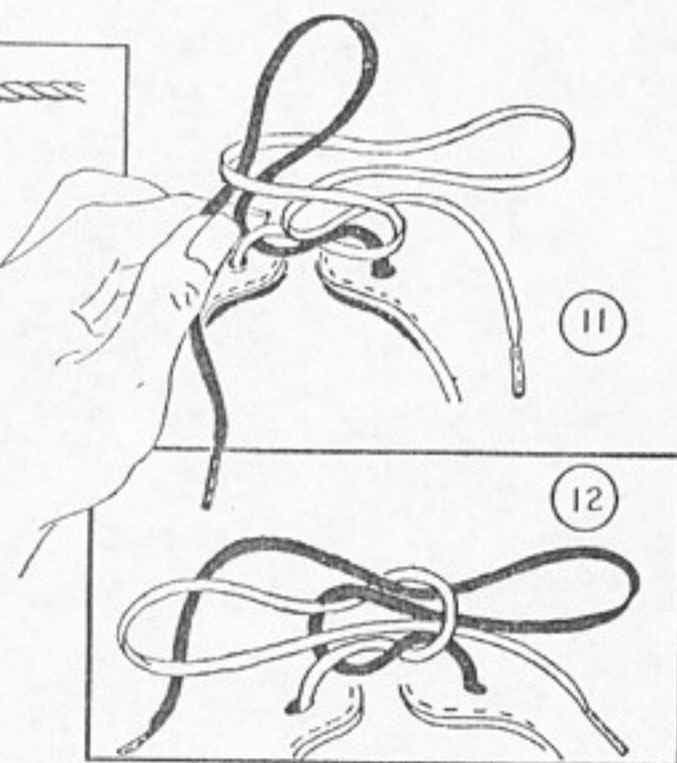
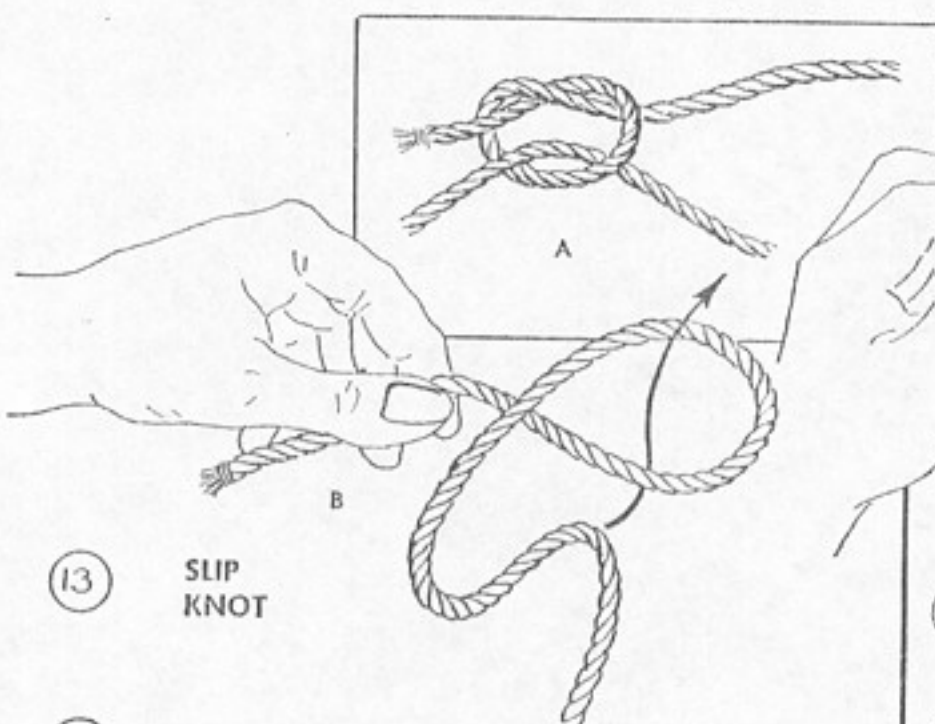
The ends of the rope should always be protected against fraying by whipping with cord, Fig. 2, by any one of the end knots, Figs. 1 and 4, or better still, when usage permits, by any one of the "stopper" knots detailed in Figs. 6, 7 and 8. These latter are known as the wall knot, Fig. 6, the single Matthew Walker knot, Fig. 7, and the crown knot or back splice, Fig. 8. The latter is a tricky one but the details A, B, C, D and E, show quite clearly how it is made and with the

8 BACK SPLICE

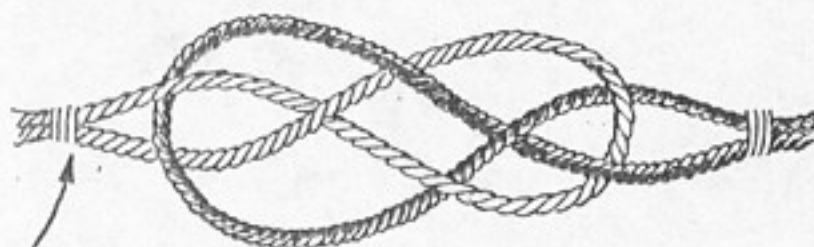
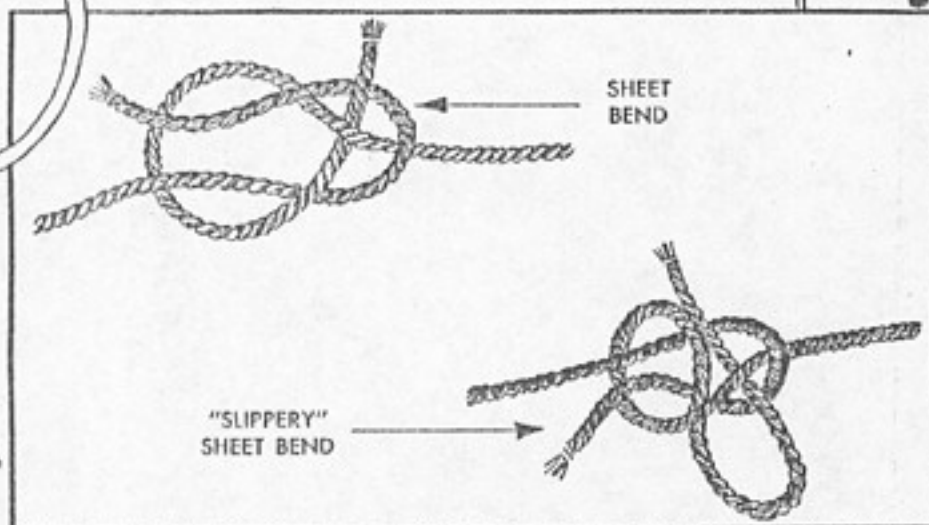
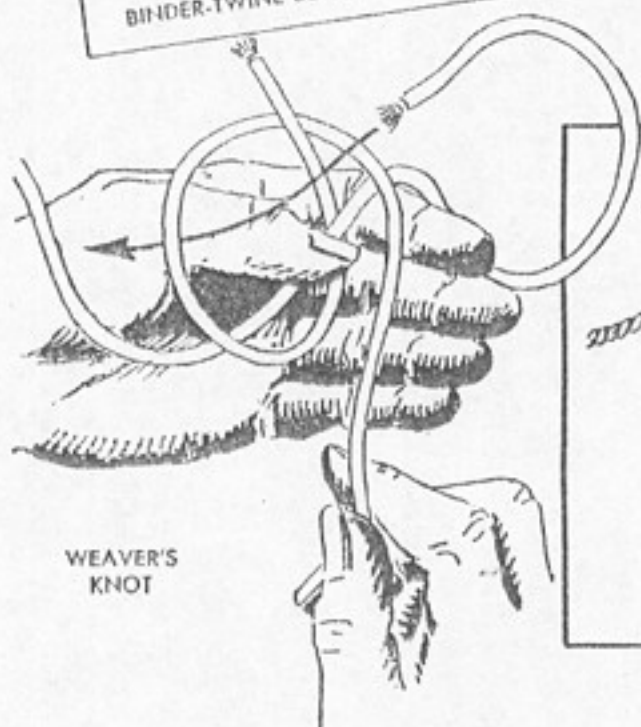
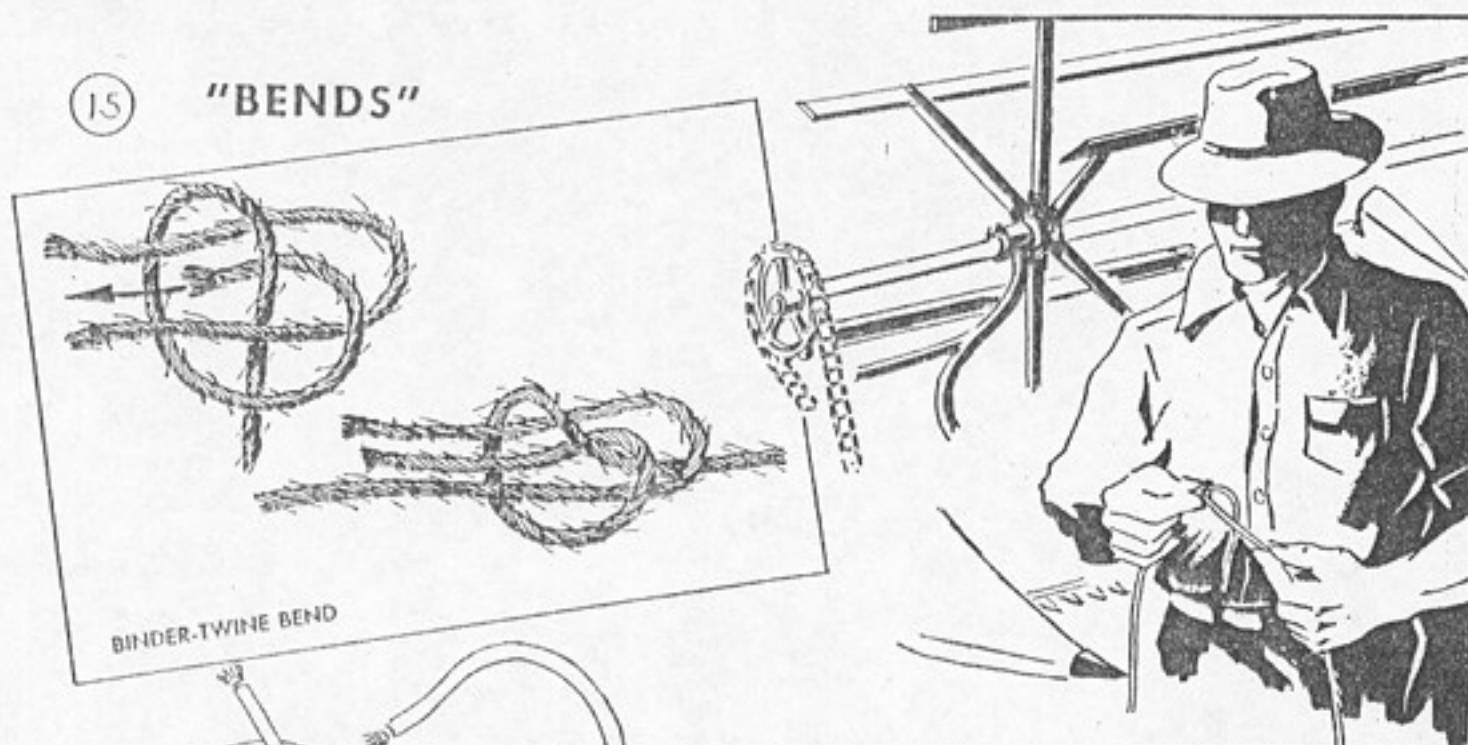
rope in your hands and the strands unlaied as in the first step A, it becomes easier still. When you end the splice lay the knot on the floor and roll it with your foot as in Fig. 9. If you're careful, it finishes off the end with a neat, professional job. The trick in getting a neat tie of either of the knots shown in Figs. 6 and 7, is to "snug up" the tucked strands separately and by stages until all three are in place and equally tight. If desired, the projecting ends of the strands may be whipped as in Fig. 2.

Right at the beginning it's important that one know how to coil a rope properly. Fig. 5 shows how to lay up an average length of rope in a flat coil, also known as the deck coil. You begin by laying the outer circle first and then winding inward in a clockwise direction giving a half turn to the rope as each loop is laid. When the full length has been laid, tighten the coil by grasping the edges and twisting it counter-clockwise. On very long ropes the same procedure is used, except that the rope is coiled in several layers. An outer wall is coiled first and the inside is built up with successive windings one on top of the

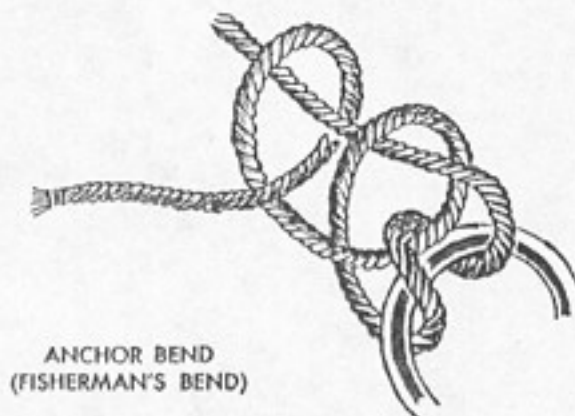
VARIATIONS OF THE SQUARE KNOT



(15) "BENDS"

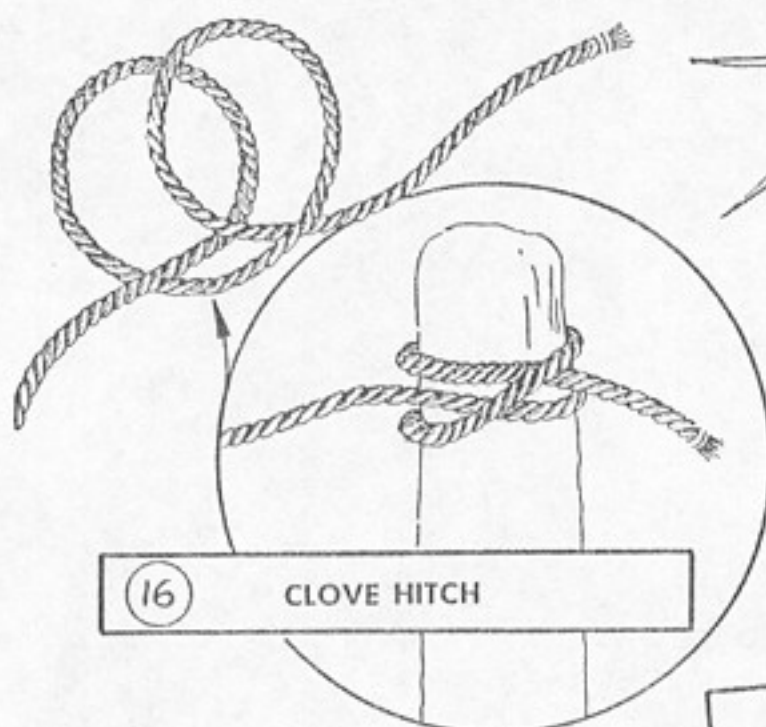


SINGLE
CARRICK BEND



The single and double carrick bends are types of joining knots which are practical for use only on large-diameter ropes or hawsers joined for towing. The sheet bend is especially useful in joining ropes or heavy cord of different diameters. The slippery sheet bend is essentially the same thing except that one end is slippery, that is, the knot can be untied merely by a tug on the free rope end

TYING ROPES TO OBJECTS



16

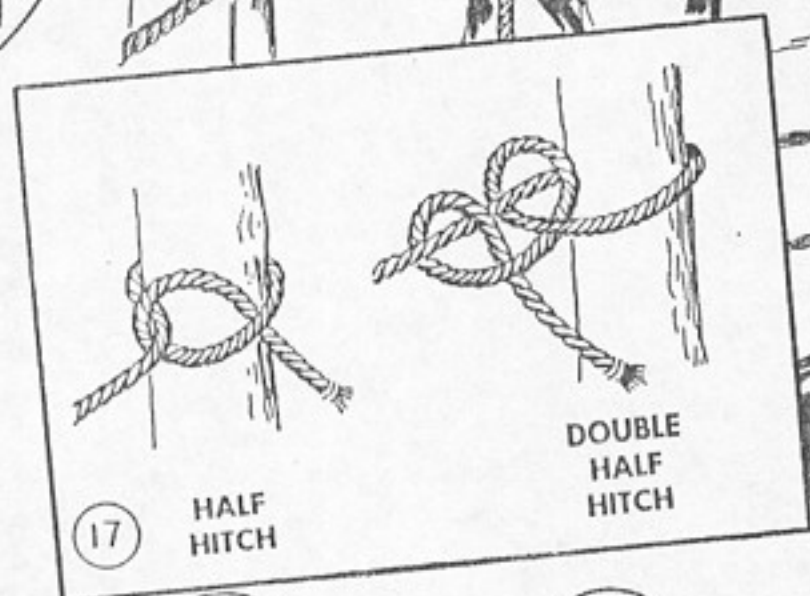
CLOVE HITCH



other. When you pay out the rope always begin with the end at the center of the coil.

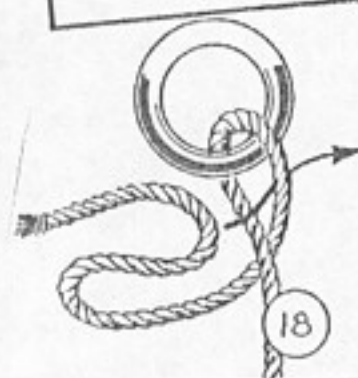
Although the shoestring tie, Figs. 10, 11 and 12, is of course in universal use there are many who do not tie it properly. Too often it ends in what is commonly called a "granny" knot. Actually the shoestring tie is a square or reef knot with both ends "slippery," that is, the ends are looped through the bights. A pull on either end of the lace unties the knot. To better understand the method of properly making the tie study the three details A, B and C, in Fig. 14, which show how to tie the square or reef knot. Note that in the second crossing, B and C, the ends and the standing part of the rope emerge from the same side of the bight formed in the other. If the end and the standing part are on opposite sides then you have the so-called granny knot which will either slip or jam under strain. The surgeon's knot, Fig. 14, is the same as the square knot except that one additional turn of each end is made on the first crossing. Under strain this will hold until the second crossing is made. Fig. 13 shows one important variation from the usual method of tying the common slip knot, Fig. 13, B. The latter is properly tied with the standing part as shown in detail B, and not with the end of the rope or cord as is so often done.

Fig. 15 details a number of "bends" which are used chiefly for joining ends

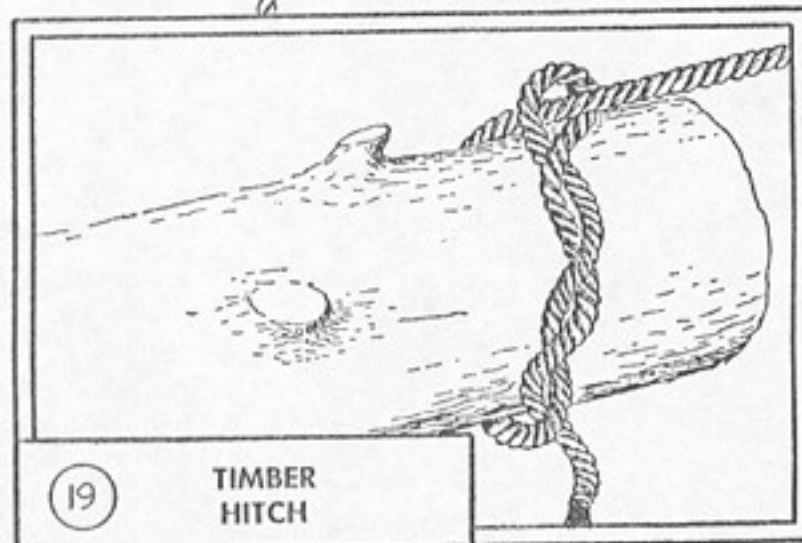


17

HALF HITCH

DOUBLE
HALF
HITCH

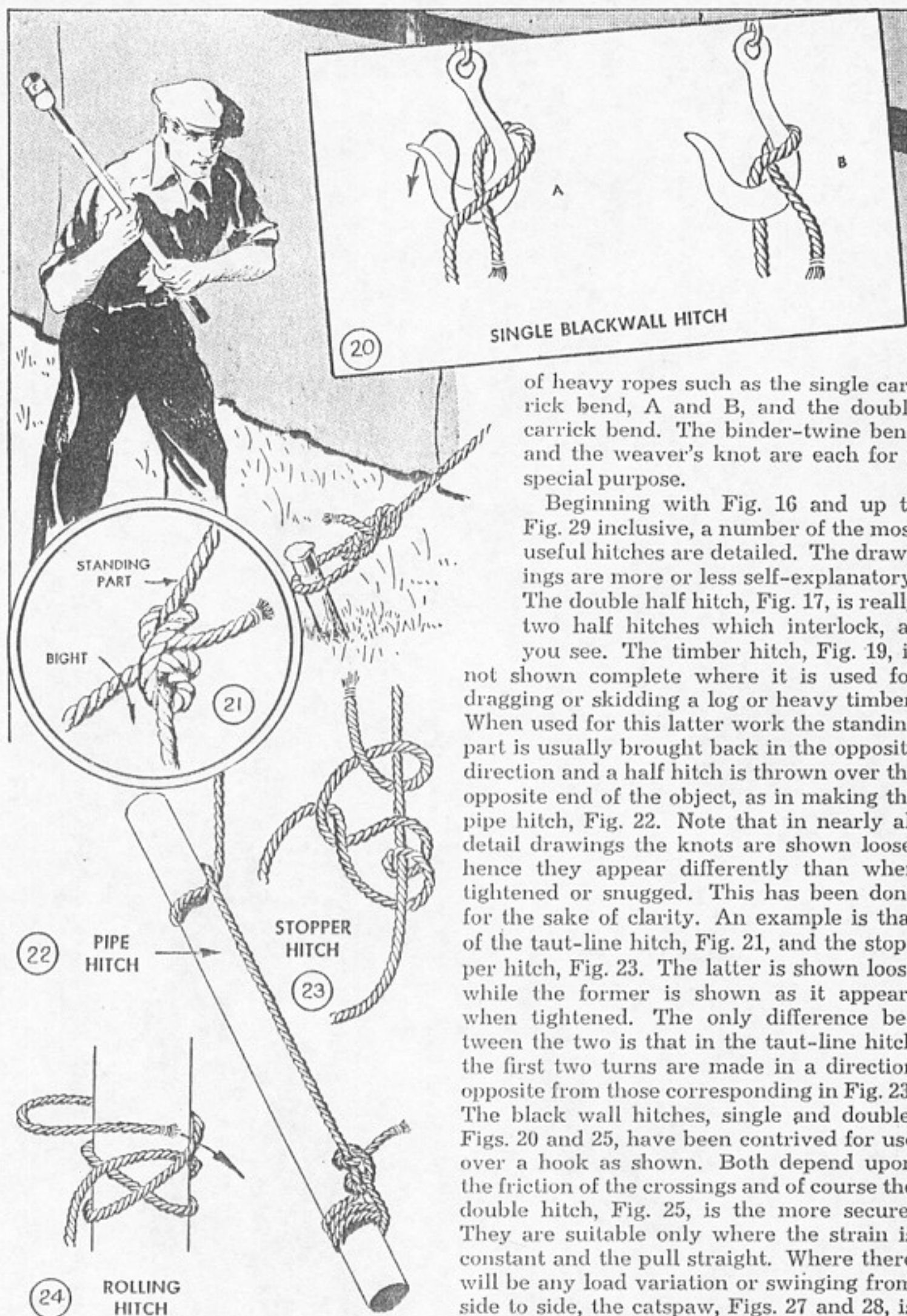
18

SLIPPERY
HALF
HITCH

19

TIMBER
HITCH

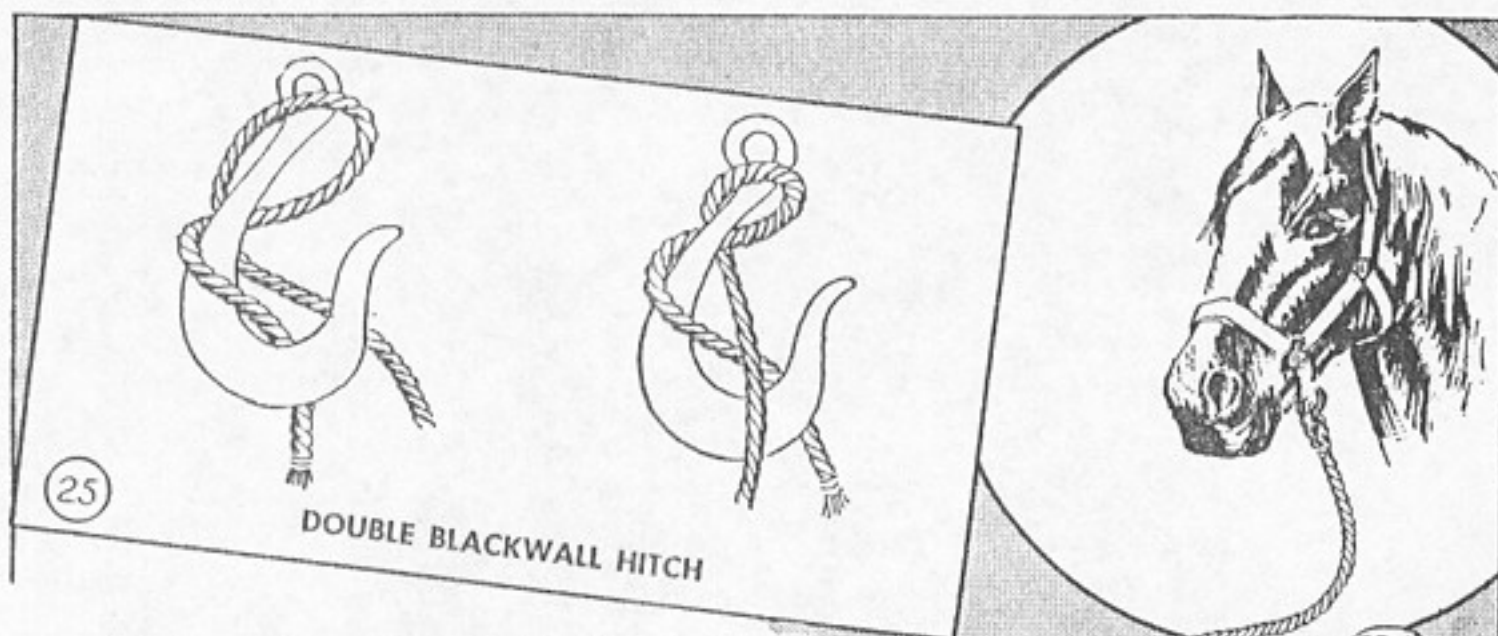
As will be seen from the above details, practically all the simple hitches are essentially the same, consisting fundamentally of turns about the object and loops in the free rope end. For the sake of clarity the timber hitch is shown above incomplete. It is ordinarily finished as in Fig. 22



All knots detailed on these pages, except Fig. 21 above, are shown loose. It should be remembered that when snugged or tightened they will appear somewhat different

of heavy ropes such as the single carrick bend, A and B, and the double carrick bend. The binder-twine bend and the weaver's knot are each for a special purpose.

Beginning with Fig. 16 and up to Fig. 29 inclusive, a number of the most useful hitches are detailed. The drawings are more or less self-explanatory. The double half hitch, Fig. 17, is really two half hitches which interlock, as you see. The timber hitch, Fig. 19, is not shown complete where it is used for dragging or skidding a log or heavy timber. When used for this latter work the standing part is usually brought back in the opposite direction and a half hitch is thrown over the opposite end of the object, as in making the pipe hitch, Fig. 22. Note that in nearly all detail drawings the knots are shown loose, hence they appear differently than when tightened or snugged. This has been done for the sake of clarity. An example is that of the taut-line hitch, Fig. 21, and the stopper hitch, Fig. 23. The latter is shown loose while the former is shown as it appears when tightened. The only difference between the two is that in the taut-line hitch the first two turns are made in a direction opposite from those corresponding in Fig. 23. The black wall hitches, single and double, Figs. 20 and 25, have been contrived for use over a hook as shown. Both depend upon the friction of the crossings and of course the double hitch, Fig. 25, is the more secure. They are suitable only where the strain is constant and the pull straight. Where there will be any load variation or swinging from side to side, the catspaw, Figs. 27 and 28, is often used. Fig. 28 shows this hitch with two complete inward turns. Well known to farmers and horsemen are the halter or hitching tie, Fig. 26, and the hackamore, Fig. 29. Both

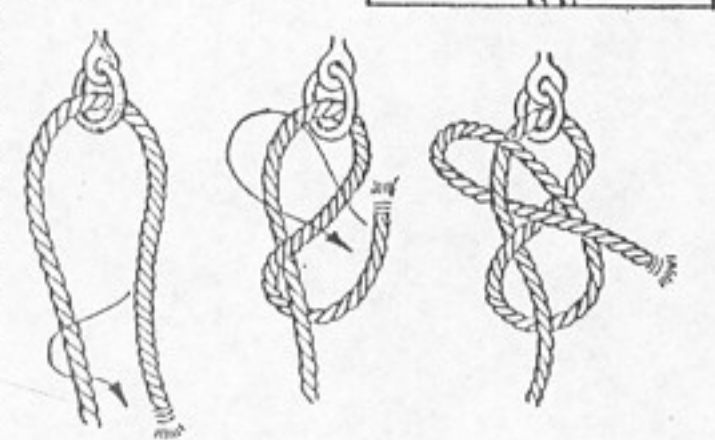
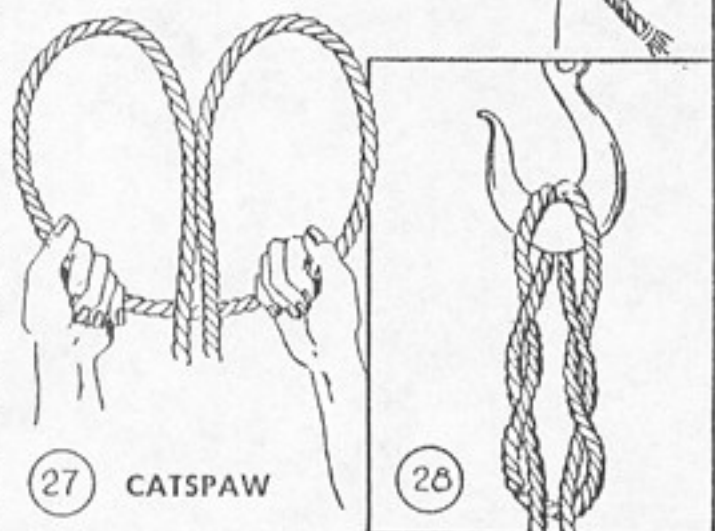
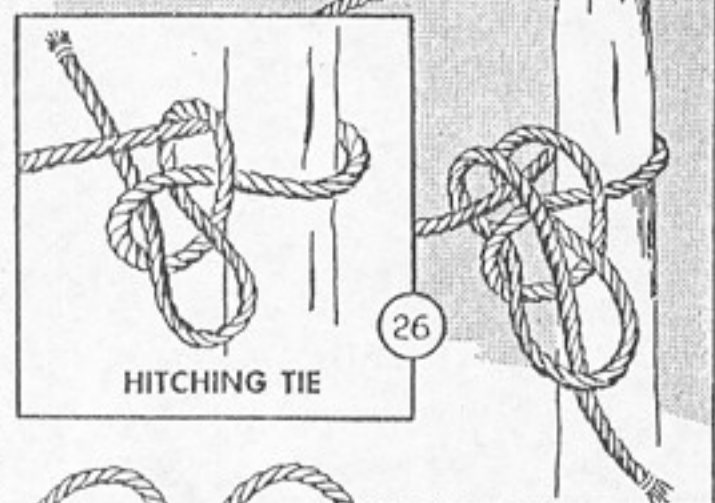


are widely used for tying Old Dobbin to the hitching post or the manger. Both have the feature of being easy to untie. The first is "locked" by passing the end through the bight as shown in the right-hand view. To untie, simply pull out the end and give it a light jerk. Note the similarity of the hackamore to the figure-of-eight knot in Fig. 3. Both knots are good ones to know as they are useful for other purposes.

When you need to shorten a rope without cutting it or you find a weak spot in a long rope which needs strengthening, then the sheepshank, Figs. 30 and 31, is the answer to the problem. Take up the slack as in the top detail, Fig. 30, then throw single or double half hitches over the loops as shown.

Everyone should know the trick of wrapping and tying a parcel post or express package securely. Fig. 32 details what is known as the packer's knot. It is simply a figure-of-eight knot with the end emerging parallel with the standing part. On square packages, place the loop over the package, center it, and pull tight to make the first crossing at right angles to the ends. Take the standing part down over one end and back to the first crossing. Take it over and under the first crossing, then around the opposite end and back to the starting point. To fasten the cord pull it tight and throw a series of half hitches as in Fig. 35. In tying a long rectangular package proceed as in Figs. 33 and 34, and finish as in Fig. 35.

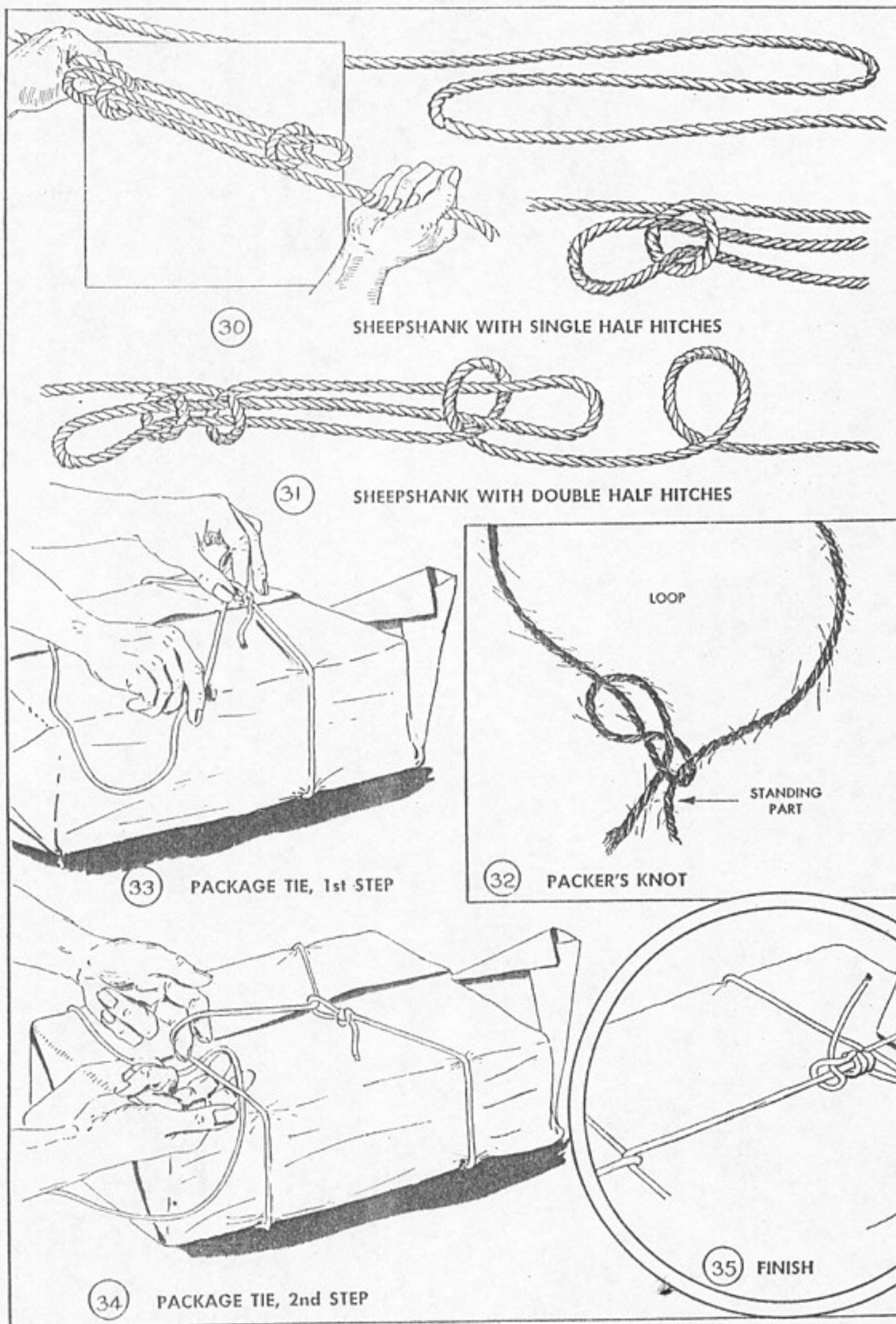
If you ever chance to be faced with a sudden emergency where quick action with a rope may mean saving a life, you should know how to tie the various forms of the bowline knot, Figs. 36 to 40 inclusive. The single bowline or bowline loop is a most valuable and important knot as it forms a loop of any required size and the knot will



29 HACKAMORE

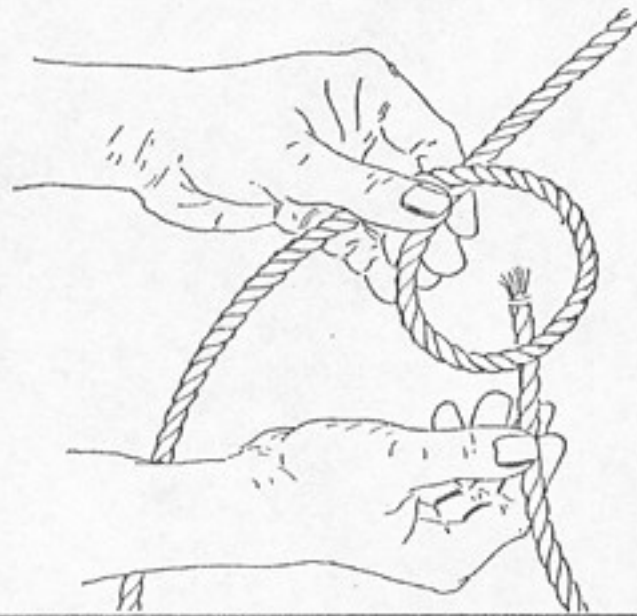
The single and double blackwall hitches hold securely when subjected to a continuous strain. However, they are safe for human life only when taken in the middle of a rope with both ends fast and supporting the load

SHEEPSHANK AND PACKAGE TIE



stand any strain the rope will bear without slipping or jamming. If one is familiar with it he can tie it in an instant and untie it almost as quickly. Although there are differing methods of tying the single bowline, that shown in Fig. 36 is one of the simplest and most common. In the Texas bowline, Fig. 37, the knot is partially formed on the standing part by passing a bight through the overhand loop, as in A and B, and then bringing the end back through the bight, C. A figure-of-eight or Matthew Walker knot in the end prevents the latter pulling out when the knot is snugged. In the double bowline, Fig. 38, A and B, the two loops are adjustable. One may sit in one loop while the other goes around the body, leaving hands and arms free. The bowline on a

KNOTTING FIXED LOOPS



(36) SINGLE BOWLINE



A

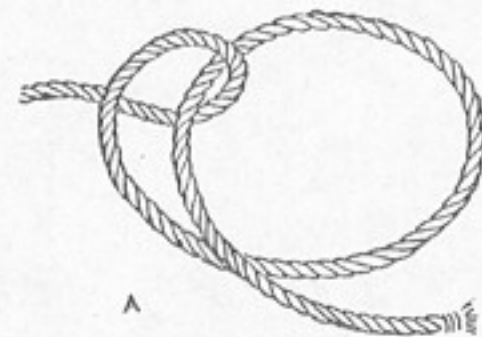


B



C

(37) TEXAS BOWLINE



A

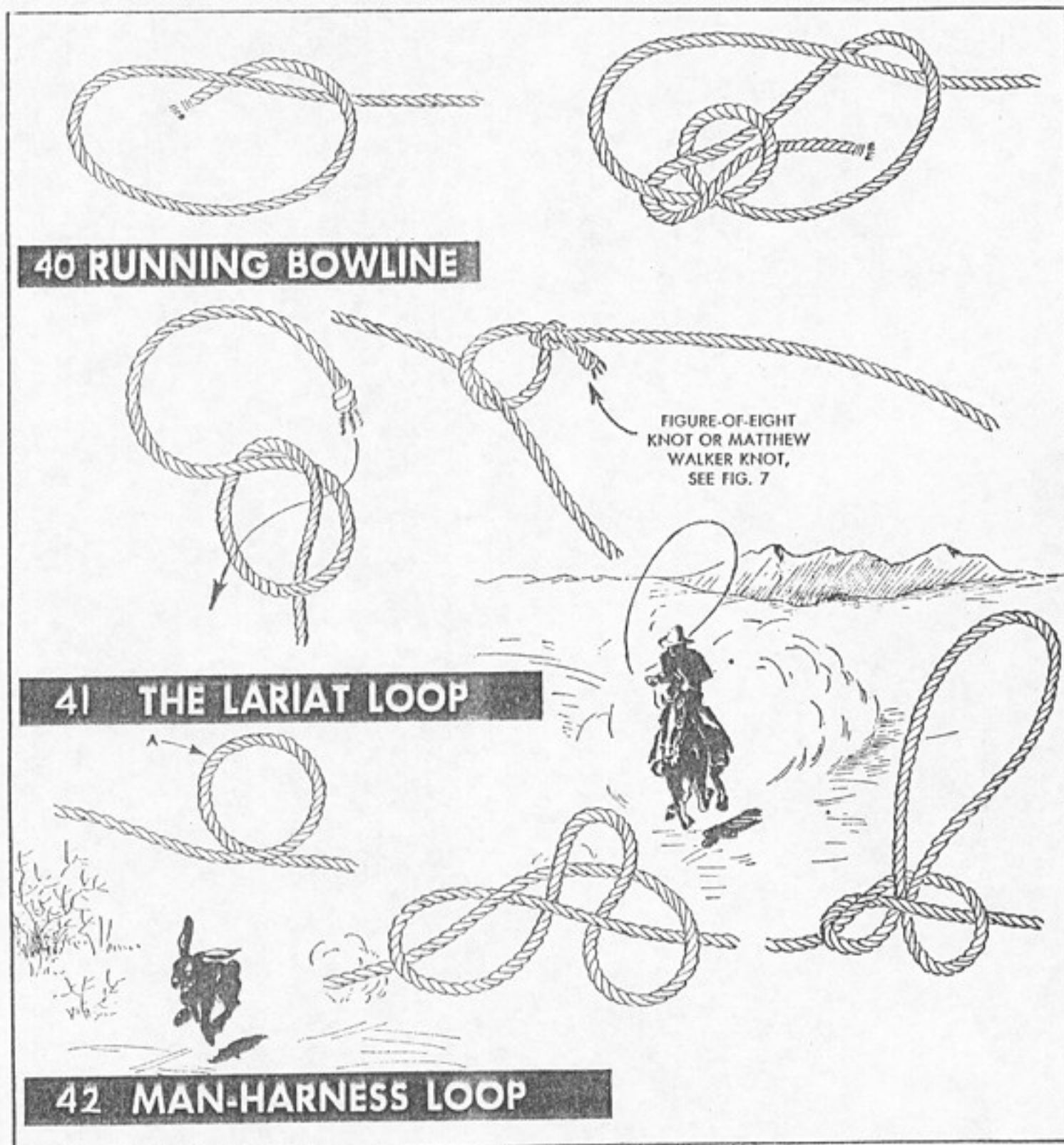


B

(38) DOUBLE BOWLINE



(39) BOWLINE ON A BIGHT



bight, Fig. 39, is useful where two fixed loops are needed. The running bowline, Fig. 40, may be started as shown in the first detail or by making an overhand loop as shown at the right. Otherwise you have to tie an ordinary bowline and then turn the loop back over the standing part.

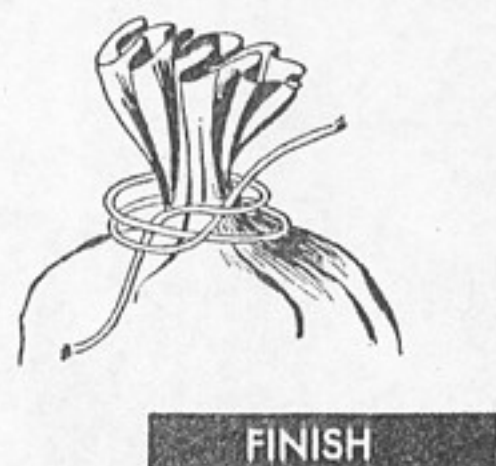
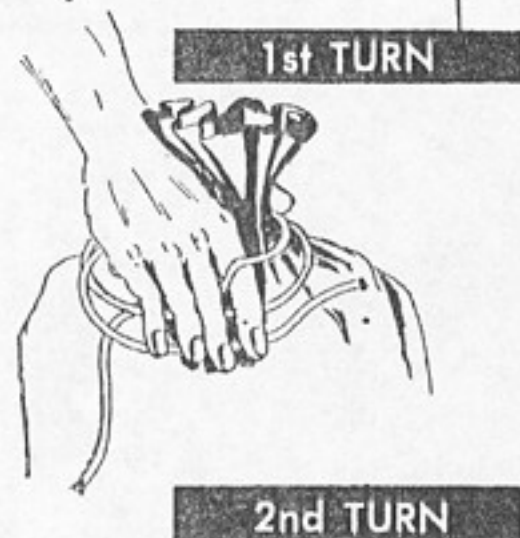
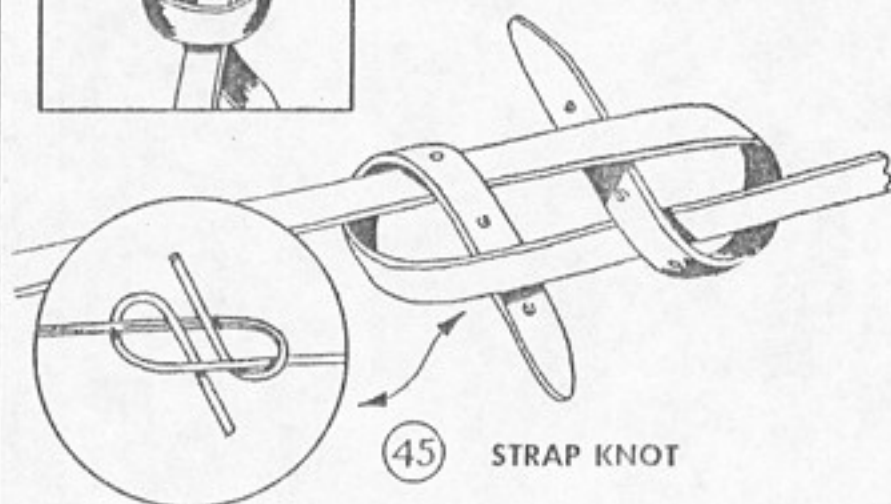
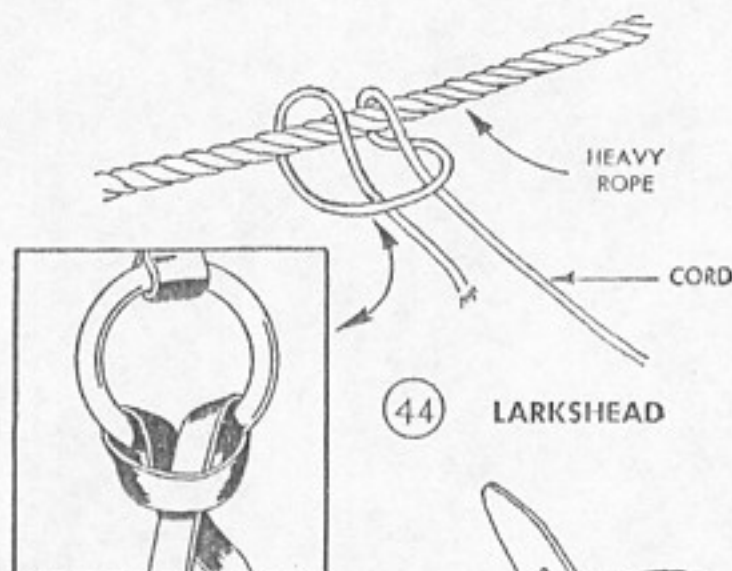
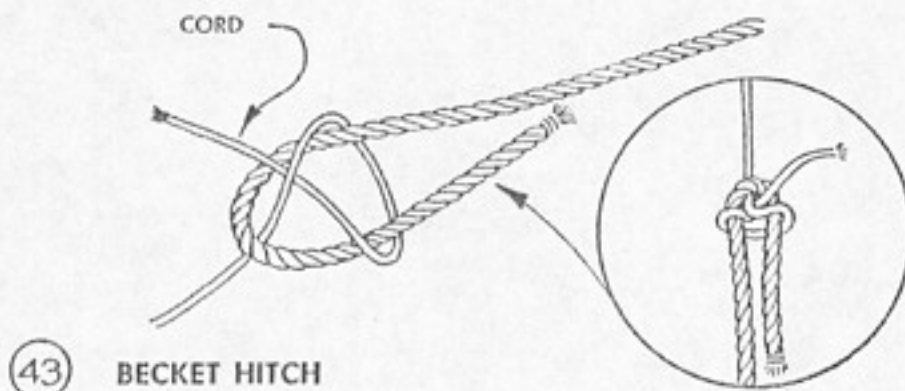
When purchased readymade lariats now are usually provided with a pear-shaped brass ring or honda spliced or seized into one end. Fig. 41 then, details what might be termed the old-fashioned lariat loop. It is also an excellent tie for other purposes as it forms a fixed loop of any practical size and is quickly and easily untied by merely loosening the overhand knot. If used for a lariat or any other purpose where the

strain is great, the end must be finished with a stopper knot as shown.

Adding manpower to a rope can be done very effectively by tying a series of harness knots, Fig. 42, in the standing part. To tie this knot you form an underhand loop as shown in the first step, Fig. 42. Actually the loop must be much larger than that indicated, which is only for the purpose of illustration. Then grasp the rope at about the point A on the loop, and bend it down and to the left. Bring it up under the standing part and over that part of the loop which remains, as in the second step. Then pull out the loop and snug the knot before putting it under strain.

Figs. 43 to 46 inclusive detail a number

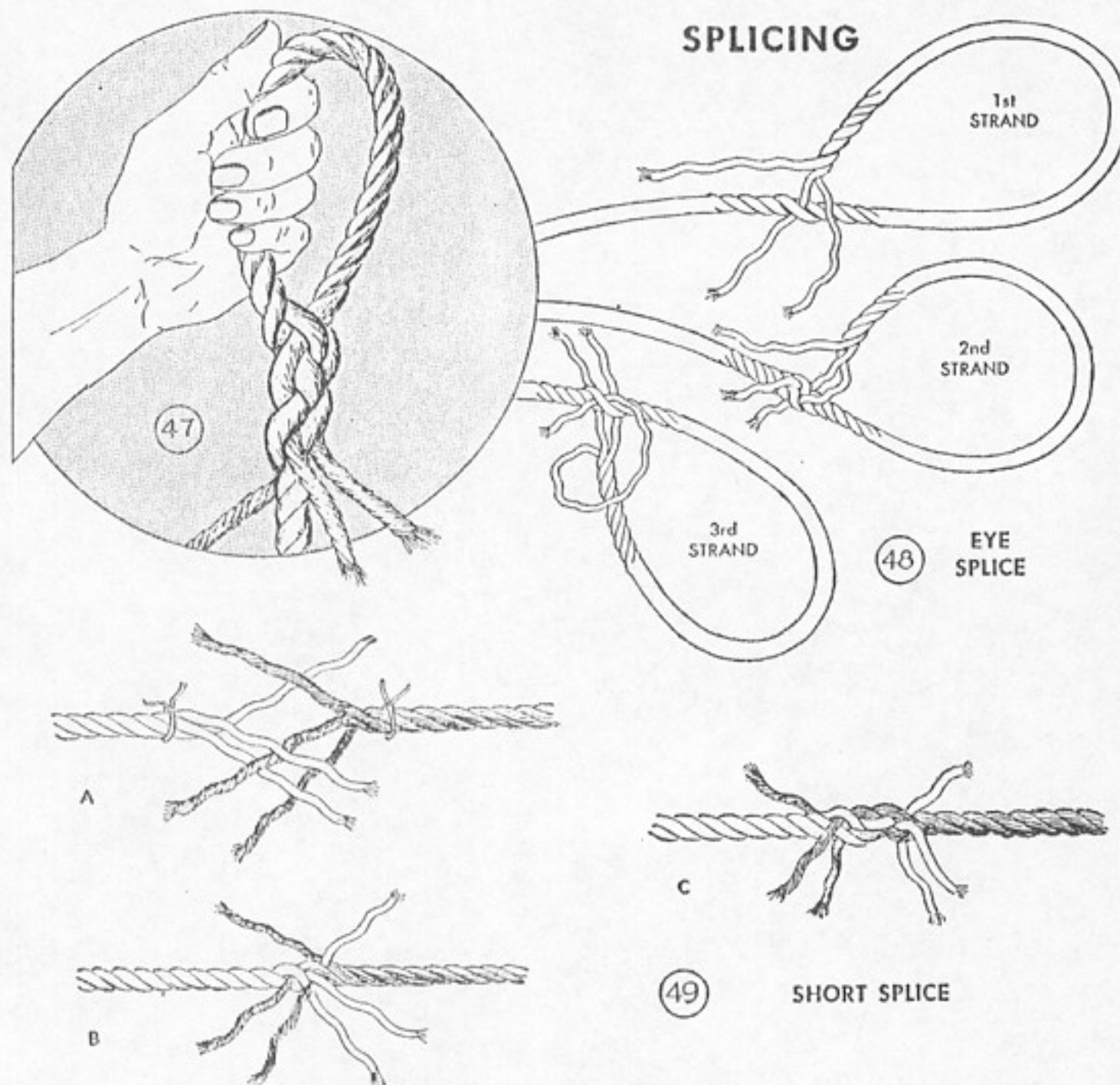
SPECIAL-PURPOSE KNOTS



46 SACK TIE (MILLER'S KNOT)

of useful special-purpose knots. Where a long rope must be taken up a ladder to the top of a building it's much easier to pull the rope up after you get to the top than to carry it up. Attach a cord to one end of the rope with a becket hitch as in Fig. 43. This simple hitch has many other uses as you can see. It's handy where it is necessary to join the ends of ropes of different diameters, or where attaching a cord to a rope will serve some special purpose. Of the several applications and forms of the larkshead, Fig. 44, only two are shown. It's handy where necessary to attach a small rope to a large one along the standing part for a pull at right angles. It also is used when tying a rope to a ring or post. The Western saddle-girth hitch is really a

larkshead tied with the cinch strap, as you see in the left-hand detail, Fig. 44. Another strap knot, good to know in an emergency, is shown in Fig. 45. It consists of two interlocking half hitches and is particularly effective in joining the ends of flat straps. A wire splice can be made similarly as shown in the circular detail, Fig. 45. Most all farmers are familiar with the sack tie or miller's knot, Fig. 46, but campers, hikers, and others who handle sacks filled with fine material should know how to tie it. As you can see, it is similar to the clove hitch, Fig. 16, and is tied by first laying the starting end of the cord over the index finger as in the top detail. Two turns are then made, each passing under all four fingers as in the second view. Then draw the



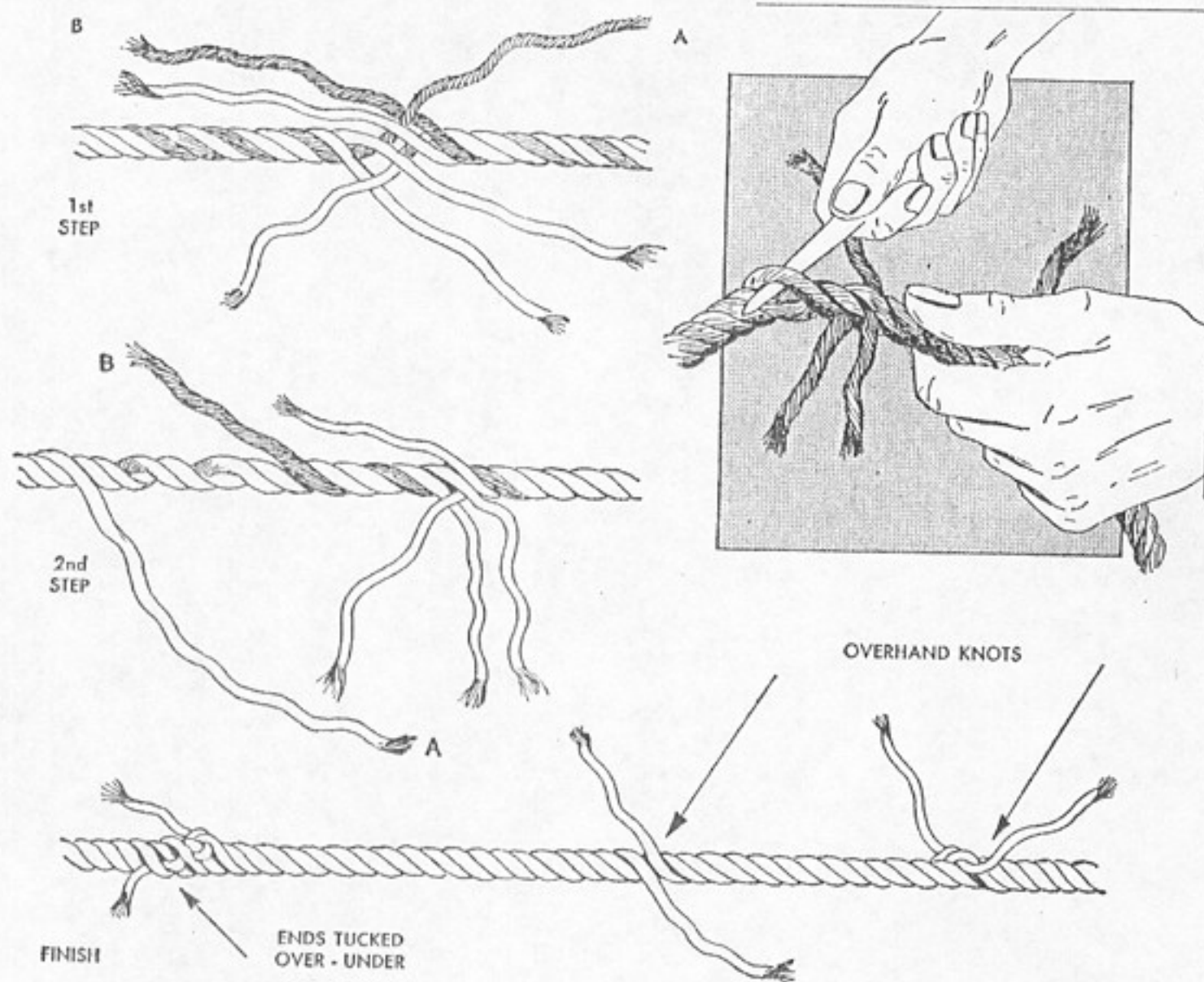
winding end, either straight or in a bight, up under the first turn just ahead of the index finger. Remove the latter, grasp both ends of the cord, or the end and the bight, and jerk the knot tight.

Now one thing to keep in mind: None of the knots described can ever be fully effective unless snugged up tight before putting under strain. Never trust a knot until you have made sure it is drawn tight. Remember, too, that the strength of the rope or cord in the knot is never as great as that of the standing part. All knots are shown tied on three-strand rope.

When rope is depended on to hold a given strain or load through knots it should be remembered that the strands and fibers within the knot tend to take a "set" where the rope is knotted for long periods of time. When untying such a knot be especially careful not to twist or kink the rope unduly, then carefully straighten the bends by

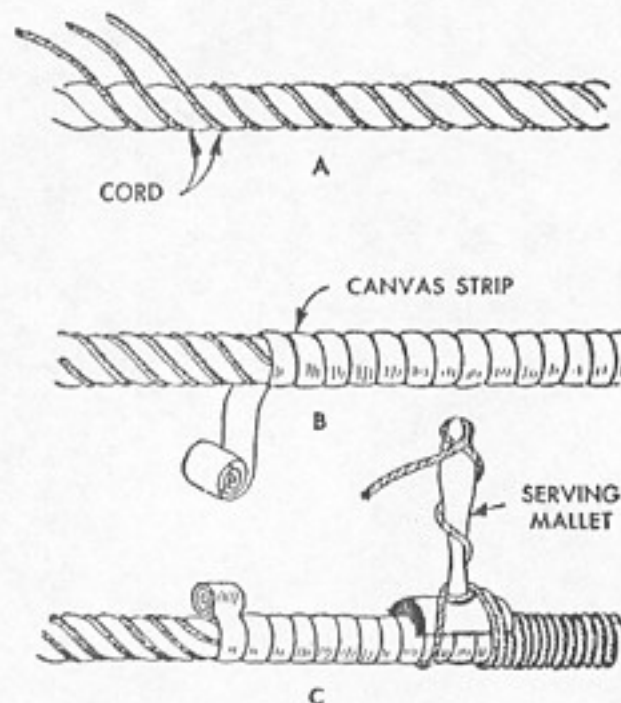
gently pulling the rope from points on each side of the affected section. Finally lay the rope out on the floor and roll it under your foot to relocate the strands and yarns. The rope should never be dampened for the purpose of straightening it.

Of all the rope splices the eye splice has the greatest appeal because of its neat, professional look. Fig. 48 shows one simple way to splice an eye in the end of a rope. The drawings are self-explanatory except perhaps for one point. Before tucking the third strand the loop or eye is turned over. After you have made two or more tucks, over and under the rope strands, the splice will tend to become bulky, as in Fig. 47. Snug up the unlaidd strands separately, pulling equally on each until you get the knot tight and smooth. Then separate each strand into its individual yarns and cut away half the latter. Finish the tucking with the half strands. This trick tapers the



(50) LONG SPLICE

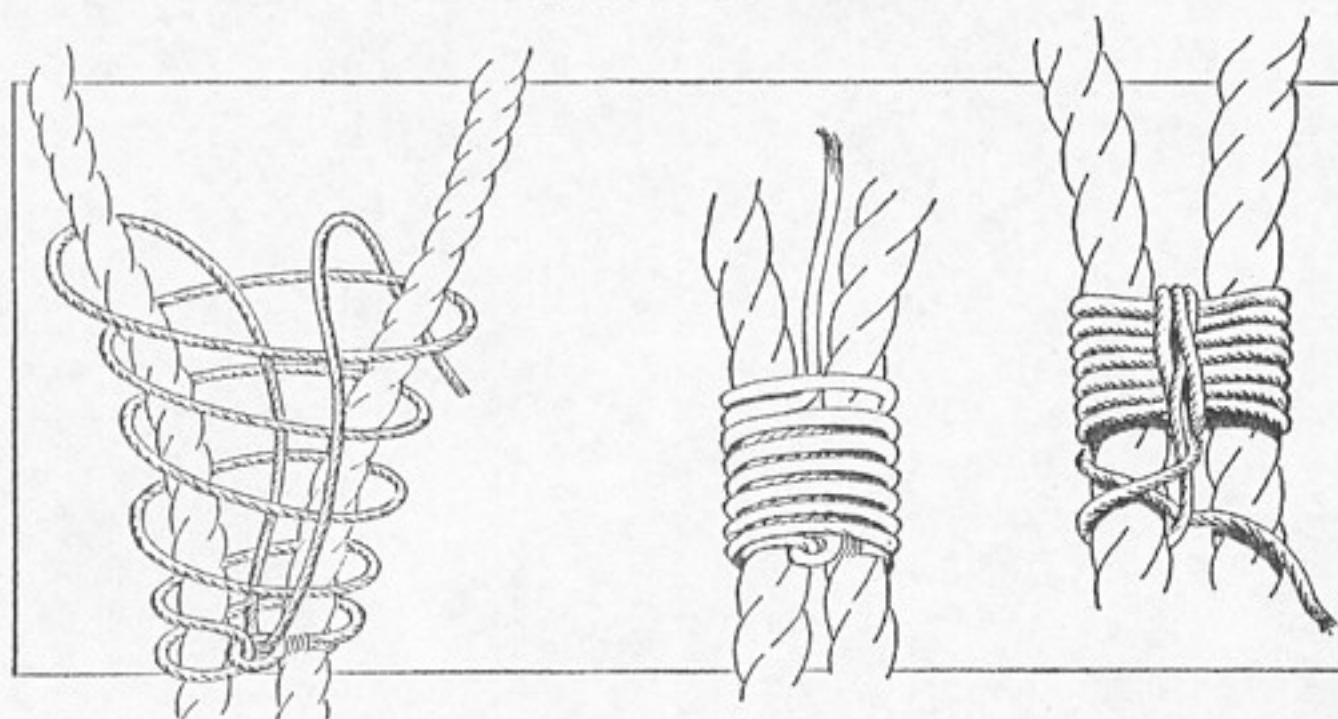
splice neatly. The short splice, A, B and C, Fig. 49, is a quick, effective method of splicing a long rope for practical purposes. Unlay 10 to 20 in. of the end strands and tie with a cord as at A to prevent further unlaying. Then simply place the unlayed ends together with the strands in the relation shown and tuck the strands of the left-hand rope over and under the strands of the right. Continue the procedure with the right-hand rope strands. Smooth by rolling on the floor with your foot. In the long splice, Fig. 50, strands are unlayed for a distance equal to 8 to 12 times the circumference of the rope. Place ends together, then unlay strand A and fill the space with strand B. Do the same with corresponding strands in the opposite direction. Finish with overhand knots and tucks as shown. Fig. 51, A, B and C, show the method of waterproofing a rope. The canvas strip B, is coated with white lead after which the cord, serving, is wound on with a special fixture or serving mallet, as shown. Figs. 51 and 53 detail the making of round and



(51) WORMING, PARCELLING SERVING

racking seizing, the latter method being used when rigging ropes together where strain on one is greater than on the other. In the round seizing the first winding is

SEIZINGS



1st WINDING

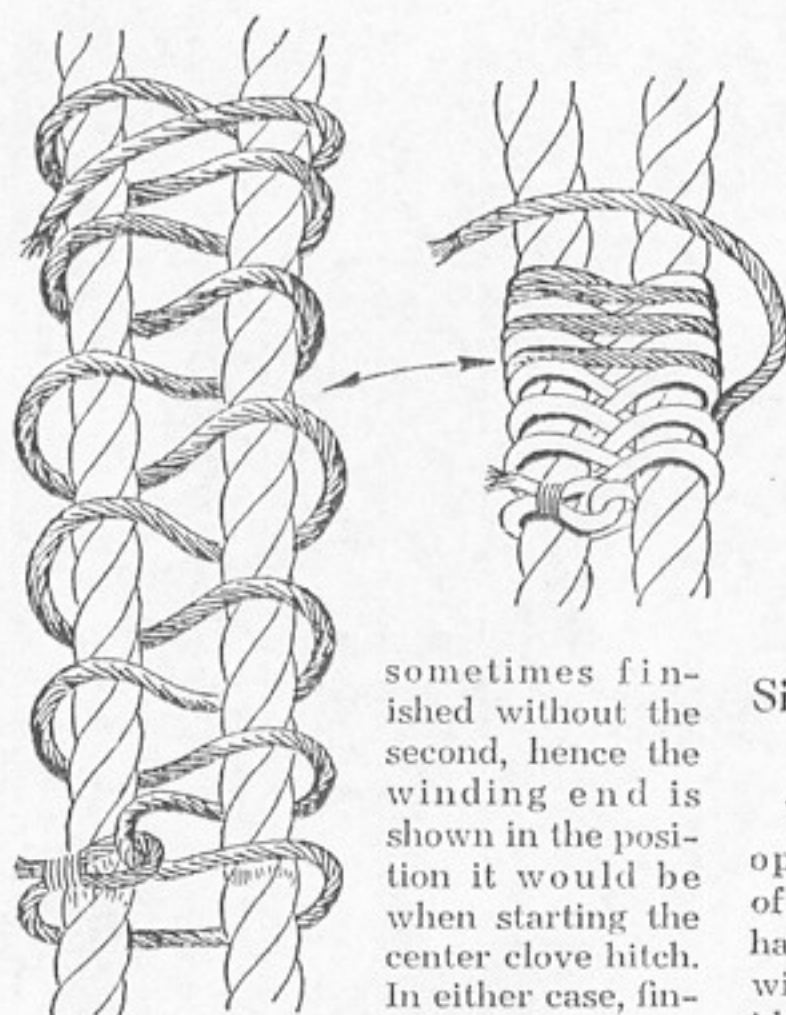
2nd WINDING

FINISH

(52)

ROUND SEIZING

usually and by stages in much the same way as you lace up a pair of high leather boots. No complicated series of loops of this nature can first be placed and then drawn up as a whole by simply pulling on the free end of the cord. The first few loops will always be loose and eventually the whole series will slacken under strain. In making any seizing it is usually best to use a cord not less than one-eighth of the diameter of the rope, although this is not a hard-and-fast rule. Although cotton cord may be used, cords of jute or sisal fibers are usually best for this purpose.



(53)

RACKING SEIZING

sometimes finished without the second, hence the winding end is shown in the position it would be when starting the center clove hitch. In either case, finish with a clove hitch around both the winding and the rope, as shown.

Making a neat seizing requires much the same skill and attention to details as making either a short or long splice. In Figs. 52 and 53 the loops are shown loose. The trick is to keep snugging the loops individ-

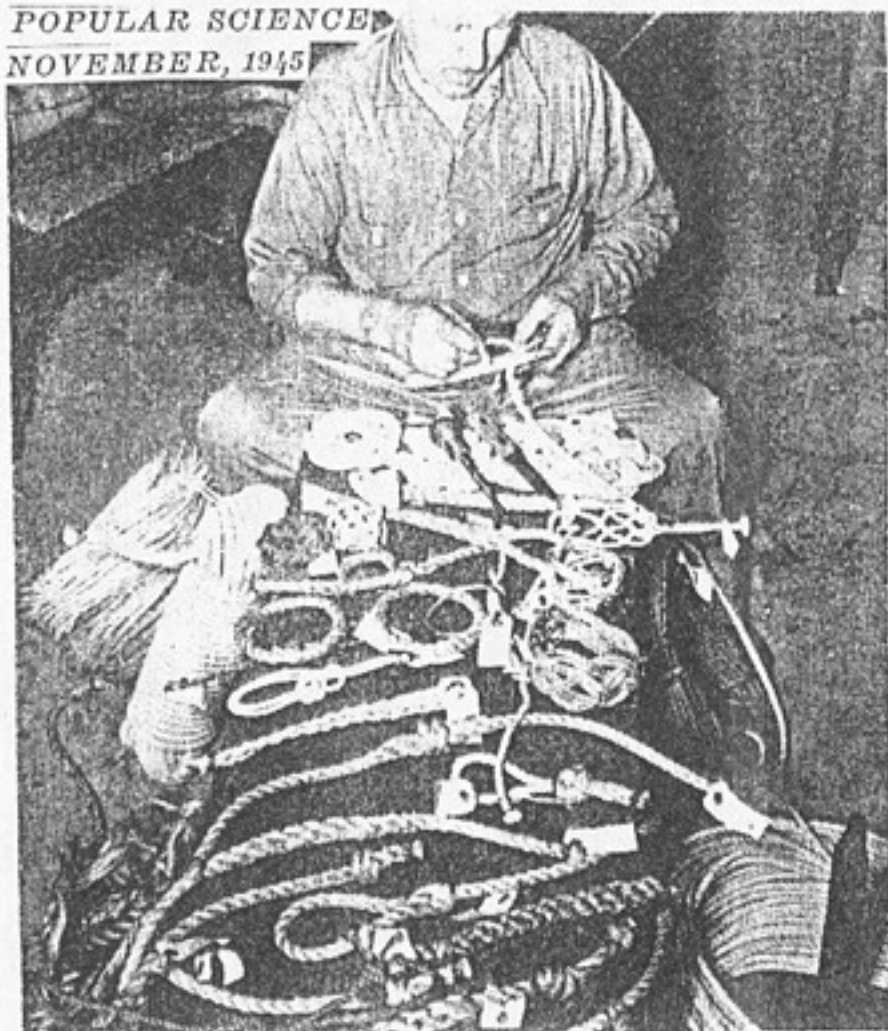
Singeing Hand Rope on Elevator Removes Projecting Fibers

Workmen who operate elevators of the type that have hand ropes will find it a good idea to keep them smooth and free of small projecting fibers. These can be removed easily

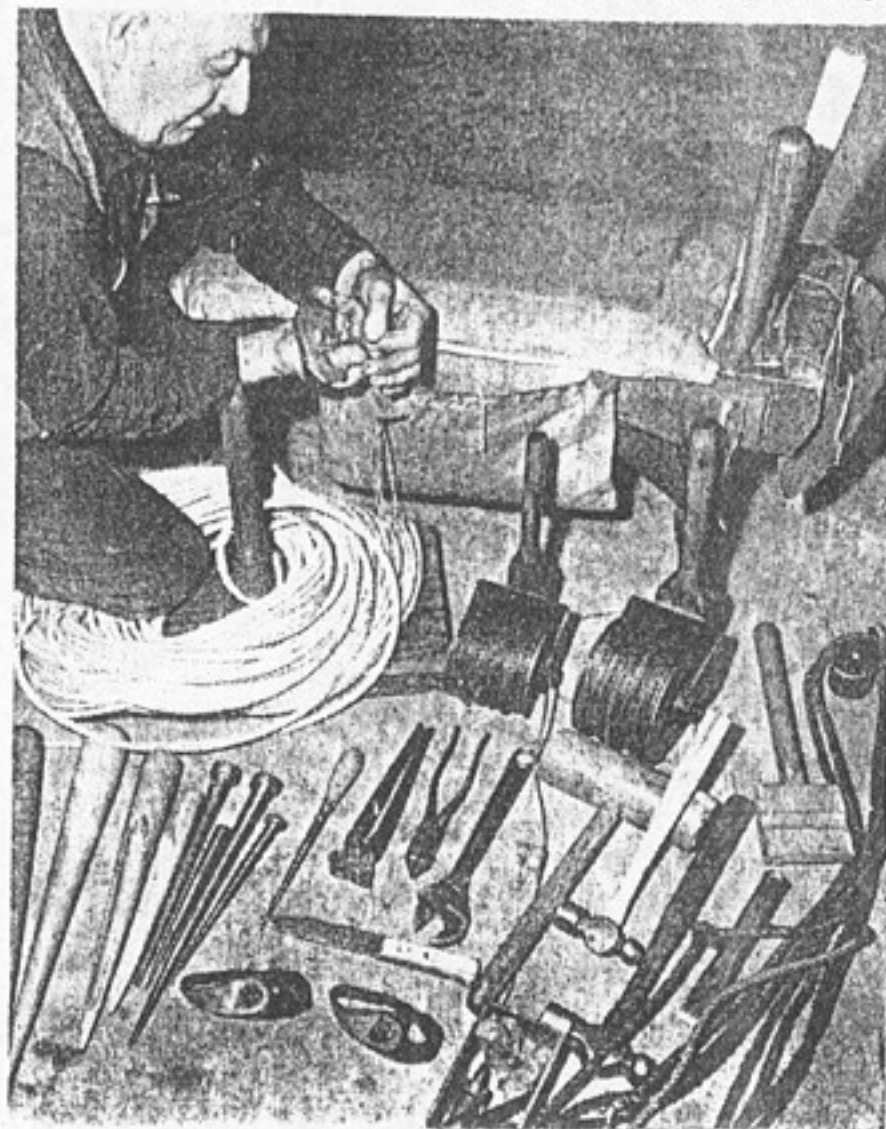
and quickly with the flame of an ordinary blowtorch, which is passed rapidly along the surface of the rope, taking care not to burn it.



POPULAR SCIENCE
NOVEMBER, 1945



These are some of the countless knots and gadgets made of rope. With them is Charles O. Strand, who went to sea at 14 and followed it for 45 years. Below, Trygve Rustad, a seafaring man for 35 years, shows tools of the ship rigger's trade—the same today as yesterday.



WHEN YOU

EVEN A LANDLUBBER, AT SEA

By Richard W. Emery

Photos by Ray Chapin

THOSE same splices and knots used by expert ship riggers in fitting out merchantmen for sea can do much for the landlubber at home. They can mend a broken tow rope, a raveled awning line, a frayed moor-



Sewing and seizing are both important operations in working with rope. The needle used is a sail needle, and the thread or seizing is sail twine. Waxing is the first step. The twine is carefully pulled through a piece of beeswax, as shown above, so it can be drawn easily through tough materials.



COME TO YOUR ROPE'S END

OR NOT, CAN LEARN TO SPLICE IT LIKE AN OLD SAILING MAN

ing rope for the family skiff, or Junior's dangerously worn swing. Pieces of useless old rope can be salvaged from the garage or workshop and made into toys or mats.

The methods today, with a few minor bows to mass production, are those that were old stuff to sailors on Columbus's *Santa Maria*. Even now, at the Maritime Commis-

sion's Calship yard, where the photos on these and the following two pages were taken, retired sailing men of 20 years and more seafaring experience are employed to tie the ship-rigging knots.

But, as Trygve Rustad, leadman there, learned 35 years ago, just get the first tuck right—then it's plain sailing.

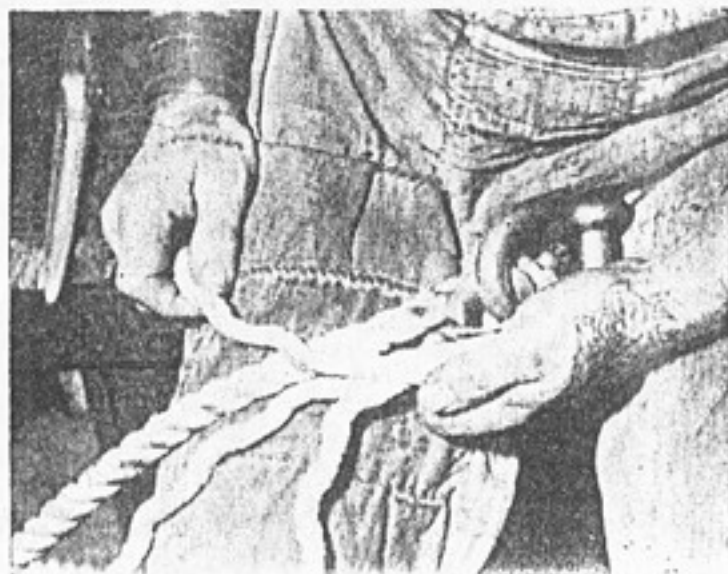


One of the ship rigger's mainstays is the leather sewing palm. It works like a thimble on the thumb of a seamstress, but fits over the hand and has a socket into which the head of the needle goes to be braced for its hard push through braided rope (right) or almost equally tough canvas (below).



A grommet, or rope ring, is made as shown at left by William Asplin, veteran of the English Navy. He sailed around the Horn during 20 years at sea.

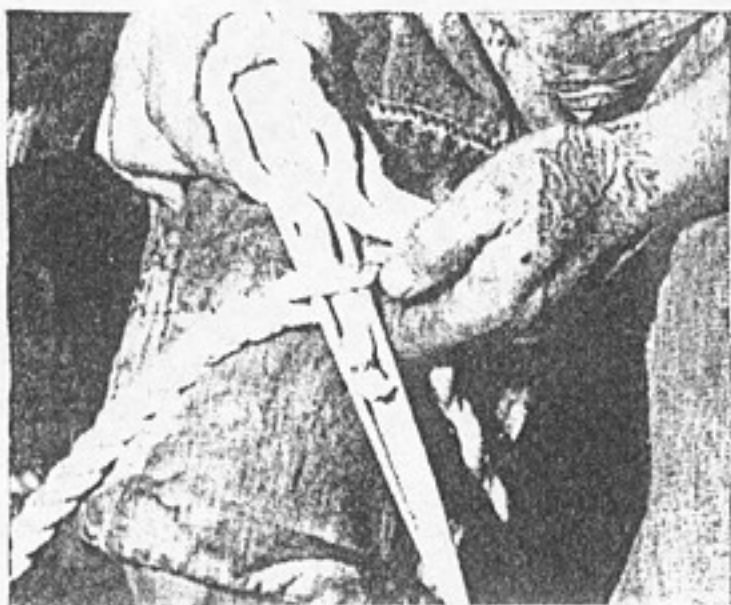
And now for the splice and how it's done. Here a three-strand rope is unraveled by a professional ship rigger for a start on an eye splice around a shackle. A galvanized thimble protects the rope against rubbing and fraying. Several more turns are unraveled before insertion of the first tuck.



Braided cotton lines, which can't be spliced, are sewed by pushing the needle through the doubled line close to the loop. The twine is given four or five turns, cross seizings are made by looping it across the turns, and sewing through the line fastens it. Make a second seizing like the first.

On the other side of the thimble, an opening is pried in the rope at the place where the first strand will be tucked. The pointed hardwood tool making and enlarging the opening is called a fid, an implement well known to seamen and similar in many ways to a marlinspike, except that the latter is made of iron. Care is taken in pushing out one strand to take the first tuck. There is an old saying among sailors: "Get the first tuck right. After that it's plain sailing." [Turn the page.]





Next, the solid fid is replaced by a fid having a groove into which one strand of the rope fits so it can be pushed through the opening. The first strand to be tucked is at the center of the three.



This center strand is tucked under the top strand of the standing rope. Here the worker holds the strands apart so they can be seen. To complete the first tuck, he grasps the tucked strand . . .



. . . and hauls the tuck tight. Unless each tuck is pulled tight, the splice will not lie smooth. At right he tightens the tuck further by cranking the point of a fid against a bight in the strand.

When the splicing has been completed, the shackle is hooked on an iron post, the rope is put under a strain, and the splice is pounded with the fid. Pounding is necessary to make a new splice round.



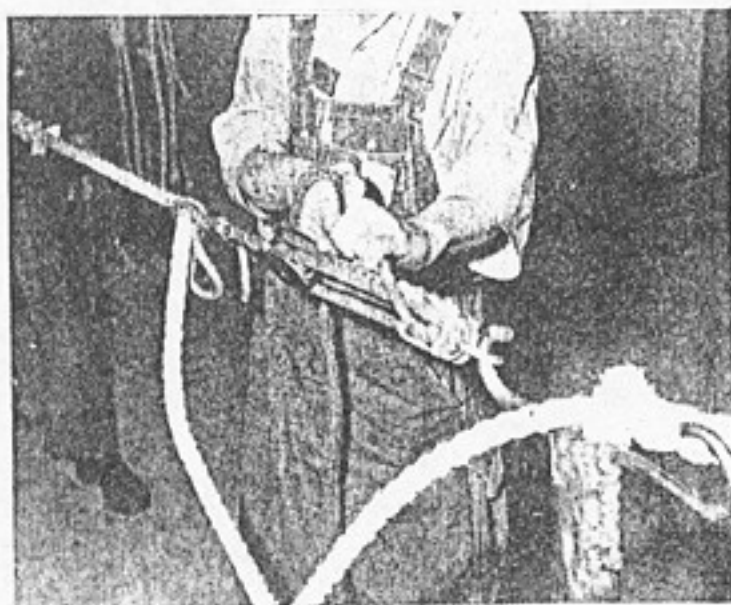
The three strands are inserted alternately under strands of the standing part of the rope. Some of the yarn is cut out of each strand on its third, fourth, and fifth tuck. This tapers the splice.

After a first pounding, rough ends of the tucked strands are cut off close to the splice in order to reduce the bulk when the splice is served, an operation in which a rope is wrapped with marline.

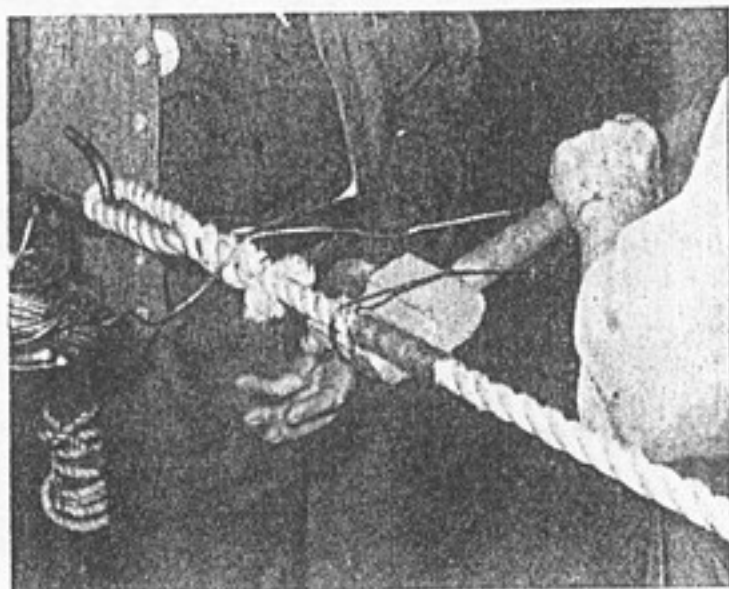




Then another thorough pounding is given the splice with the rope still under heavy strain similar to that it will get in actual service. Strain on the rope stretches it somewhat and makes it slimmer.



Nothing more than a small block and tackle like this is needed to put a heavy strain on a spliced rope. Unless the rope is under strain while it is being served, its wrappings later work loose.



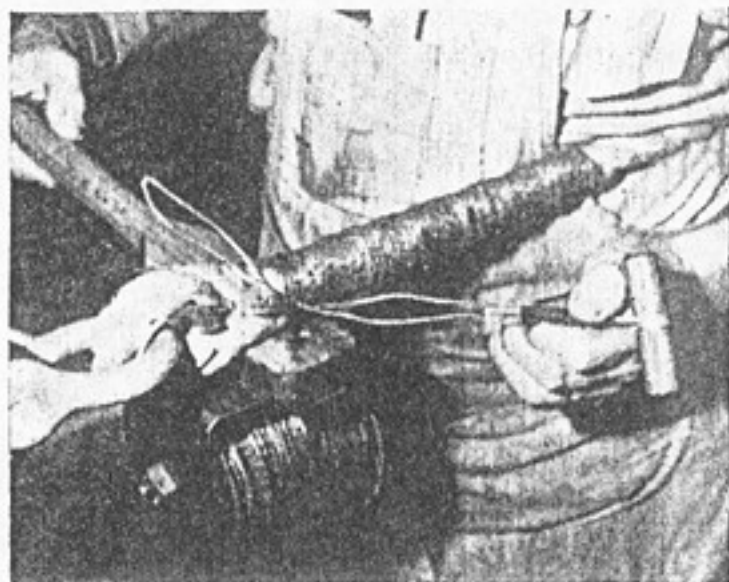
And then the serving begins. Formerly this was a time-honored two-man operation in which one man was needed to rotate the ball of marline around the rope while the other turned a serving board.

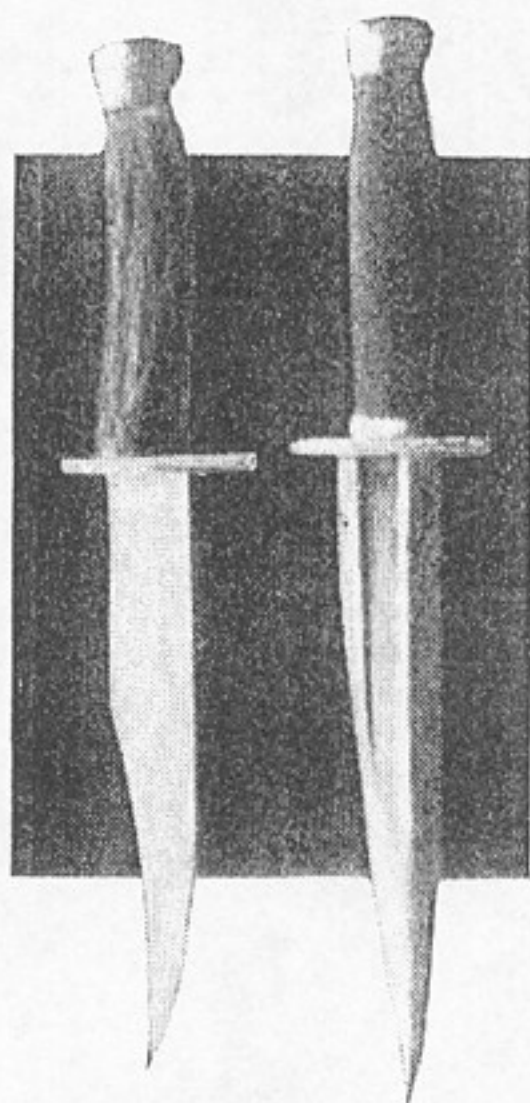
When the serving nears the thimble, a snaker is inserted and several turns of marline are wound on it. The snaker is a sharply doubled wire with which the end of the marline can be pulled back.



Wartime production has introduced an improvement requiring the service of only one man, who uses a serving board with a reel that keeps tension on the marline by means of a bolt through the axle.

Then the marline end is pulled tight while lying in a groove between two rope strands. It is next pulled upward to cross the strands and is cut off. In this position it is under greatest pressure.





WITH steel from an old bayonet, butcher knife or even cut from a discarded circular saw a very good-looking hunting knife can be made by putting on an attractive handle. Two designs are shown here, each with a different type of handle.

In the all-around woodsman's knife, a slotted bolt is pinned or brazed to the shank of the blade, an aluminum or brass guard slipped on as shown in the exploded view, then leather washers forced tightly together by the end piece, which serves as a nut.

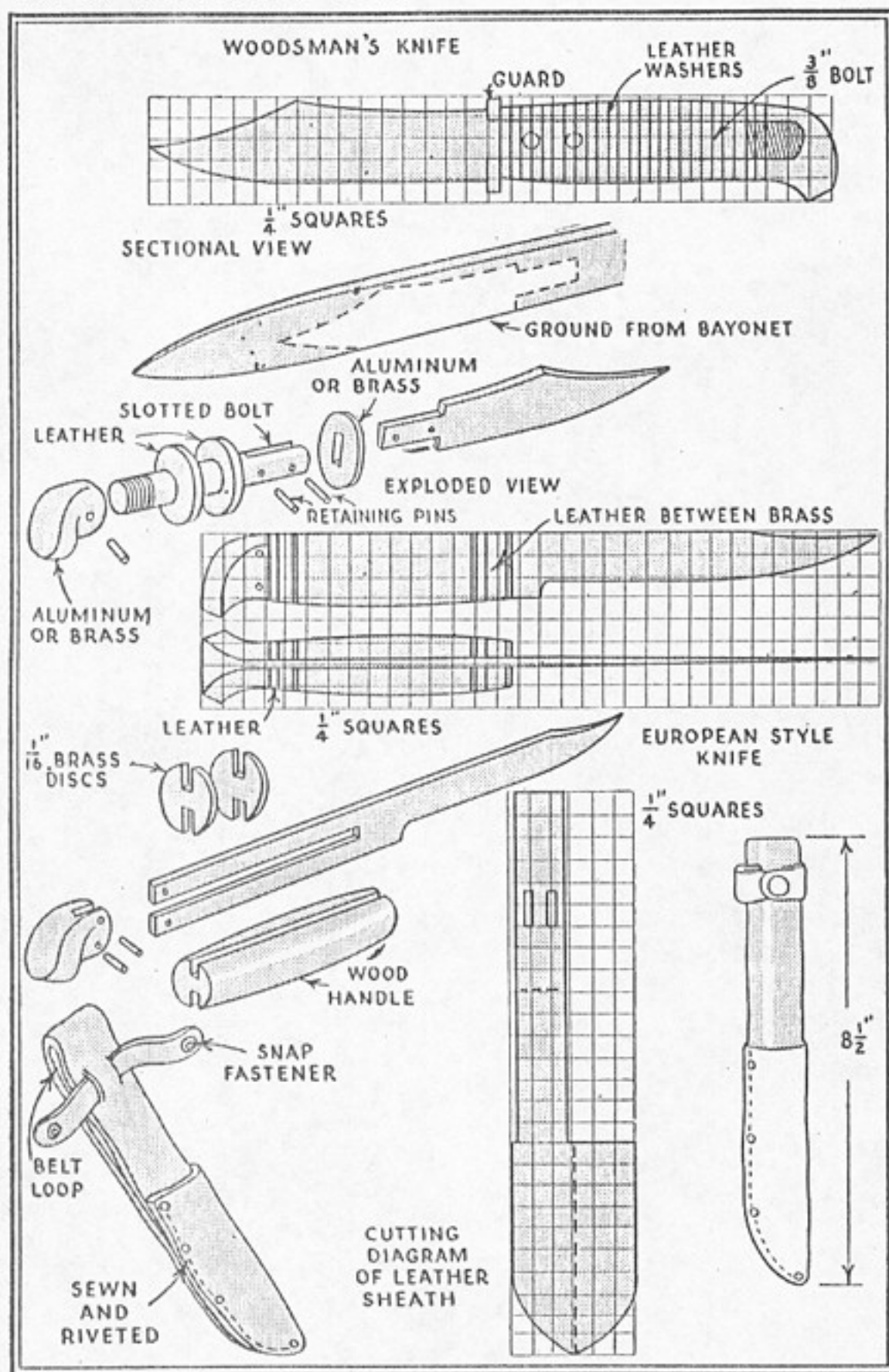
For the European style knife, the shank of the blade is slotted, the metal disks and leather washers cut to fit as shown, the wood handle slipped on, and the assembly then clamped endwise in a vise and drilled through the end piece for the retaining pins.

In each case the handle is finished with rasp, file and sandpaper after assembly. Rosewood makes an attractive handle for the European knife, and plastic wood or bakelite can be used

Make a Hunting Knife

By ROBERT L. SMITH

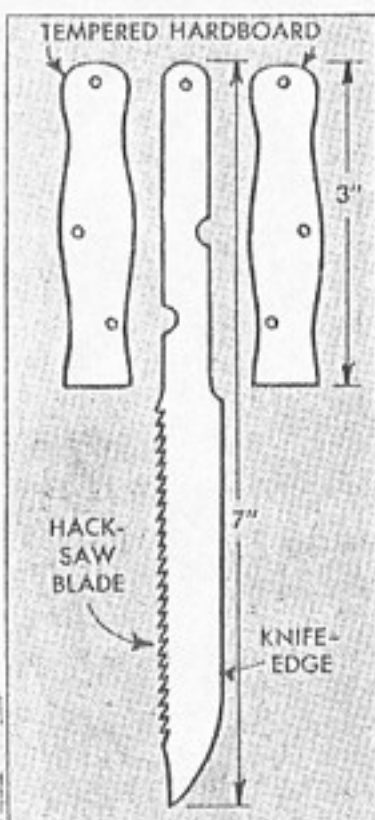
DO IT YOURSELF, 1949



for either. If brass or aluminum is not available, steel or even iron may be used in the metal parts of the handle. In grinding the blade to final shape, use grindstone instead of emery wheel, as you'll find that using an emery wheel will tend to take the temper out of the steel blade.

Kitchen Knife Fashioned From Hacksaw Blade Handy for Peeling Vegetables and Sawing Bone

POPULAR MECHANICS, 1951



A real timesaver, this kitchen knife has both a keen cutting edge for vegetables or meat and a sharp, saw-tooth edge for bone and gristle. The knife is ground from a hacksaw blade and fitted with a handle of $\frac{1}{4}$ -in. tempered hardboard. A piece of hardboard is cut to fit each side of the blade and registering holes are drilled through both pieces to permit riveting them together. The edges of the hardboard are rounded and the ends of the rivets are ground flush with the handle. Finally, the crack between the handle sections is filled with plastic wood and the handle is shellacked. — J. Harley Hosack, Hartford, Conn.

SUNSET May, 1966

These individuals are rock dolls

On a visit to the desert or the beach, families can collect all the raw material they need for the project of making "rock dolls."

It can be a challenge to the imaginations for any age group. Let the varying shapes of the rocks, in combination, suggest the people and animals that your dolls will represent.

After you glue a rock head, hands, and feet to a stone body and then decorate it, you may see a use for it as gift, ornament, or toy.

Wash the rocks (they dry rapidly) and spread them before you on newspapers, stacking and combining them experimentally. (Don't combine rocks in precarious balance, or you'll put too much strain on the glue.)

Using the proper glue for this project is important. You'll want something quite thick, so you can use your fingers or a toothpick to build up a little platform or collar of glue. Then, in its collar, one rock will sit securely on another in spite of irregularities in the shapes of both rocks. You also need a good strong glue so that the rocks will not break apart. The epoxies are best for strength, and a

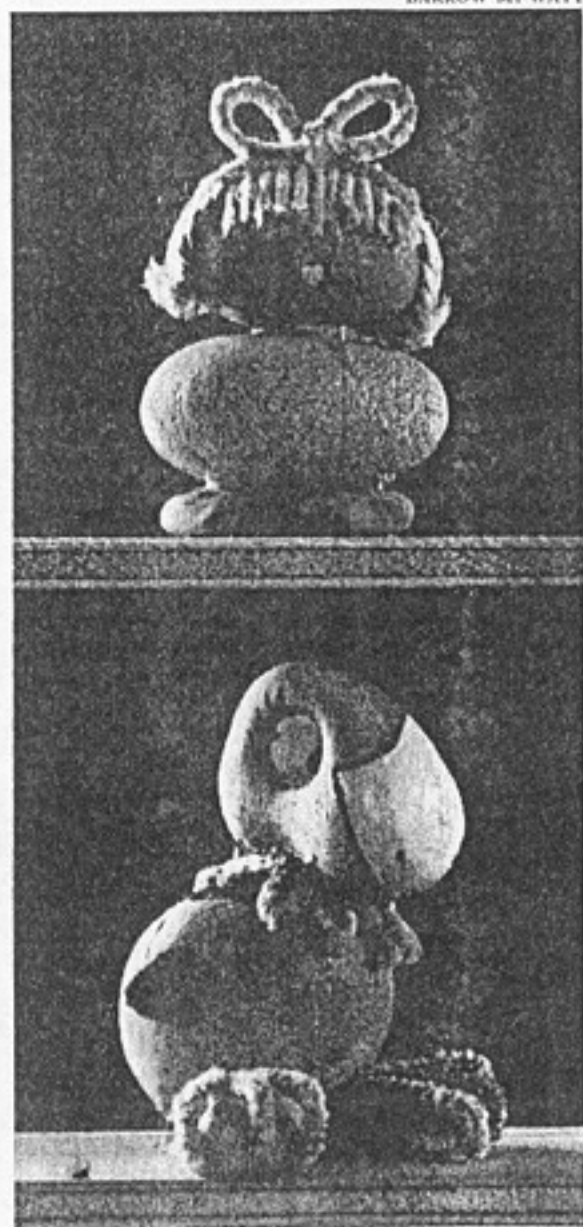
number of them are thickened in various ways. There is also an epoxy putty that works well. If you have difficulty finding these at the hardware store, try a marine supplier.

Decorate the dolls with wigs, faces, and props. Use white glue to attach colored pipe cleaners and construction paper. In general, though, it's best to go light on decoration and let the figure take its character from the peculiarities of the rocks themselves.



Rock dolls are fun to make: girl with twine hair, parrot with pipe-cleaner feet and ruff, gentleman with newspaper

DARROW M. WATT

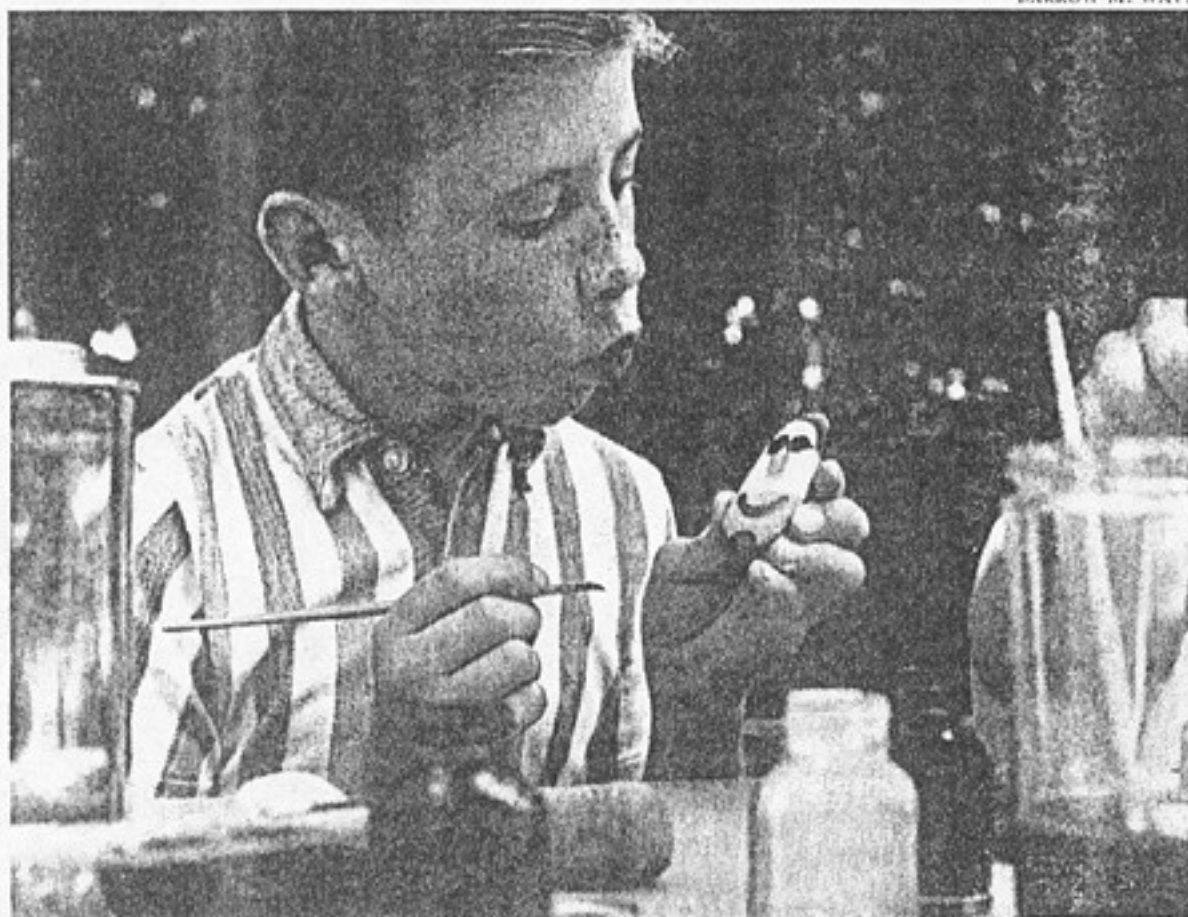


BARROW M. WATT

SUNSET OCTOBER, 1965

You just paint faces on rocks

Painting faces on rocks offers great fun and a chance for self-expression to both grownups and children. Youngsters seem to feel immediately at home with the project, and require little help or supervision. It's a good party game; you can give prizes for the most originality. Materials



Blowing on paint hastens drying of rock face. It's fun to make such faces for place cards for a children's party. Or call them paperweights and present them as gifts



Sampling of the variety of the faces you can produce—these by Madeleine Christenson and family, Eugene, Oregon. Paint dries dull on porous rocks, shiny on harder material

are inexpensive, and the work creates very little mess. You can spread out some newspapers on a table top; the work area can be small.

In addition to some flat, fairly smooth rocks, you'll need very inexpensive water-color brushes, turpentine or acetone, a few small bottles (bright colors) of butyrate dope—a paint used for making model airplanes and usually found in hobby shops—and some paper towels or paint rags for cleaning off mistakes and washing the brushes.

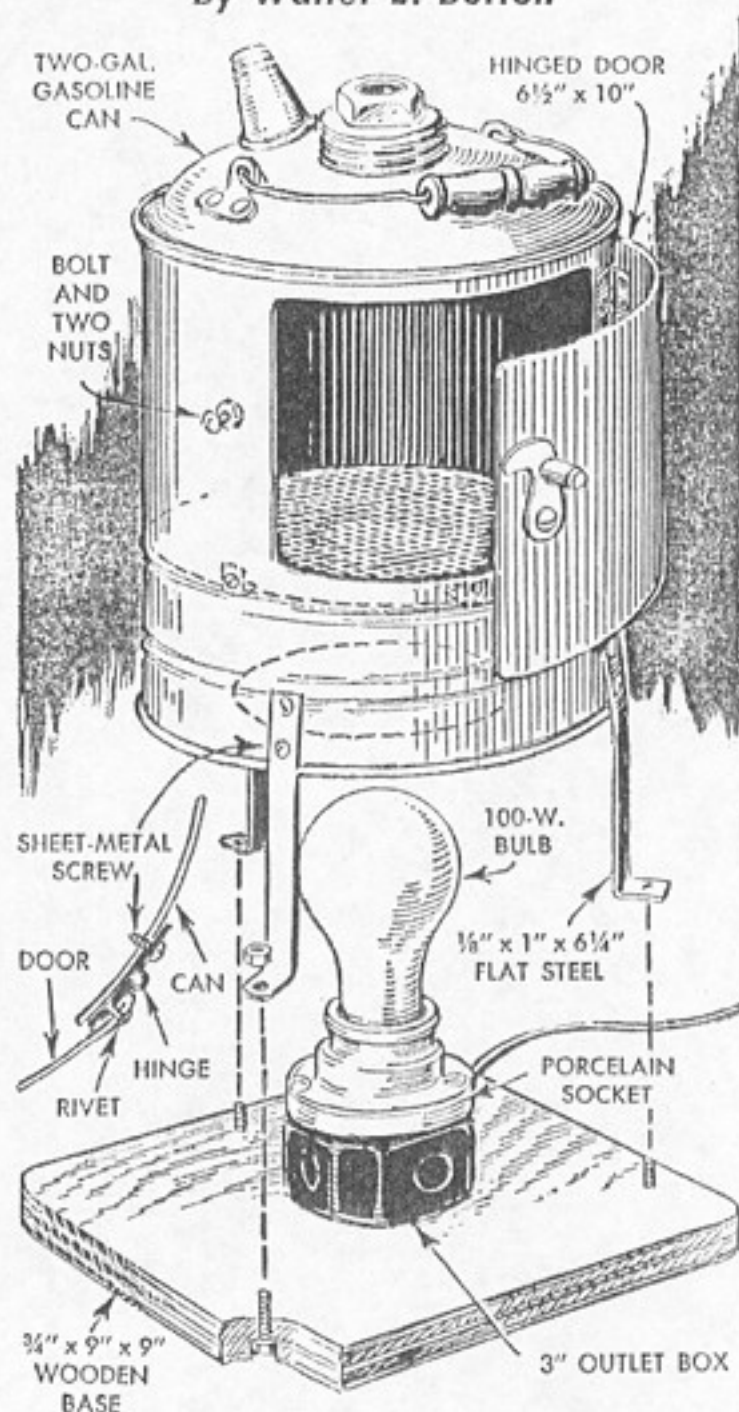
For the most interesting effects, let the rock suggest the design. Some seem to look like fish, others like cats, monsters, primitive looking masks, whimsical faces. You can paint one color over another by waiting a couple of hours for the dope to set, or you can leave a little space in your design between colors. Don't overload your brush with paint.

DRYING OVEN FOR

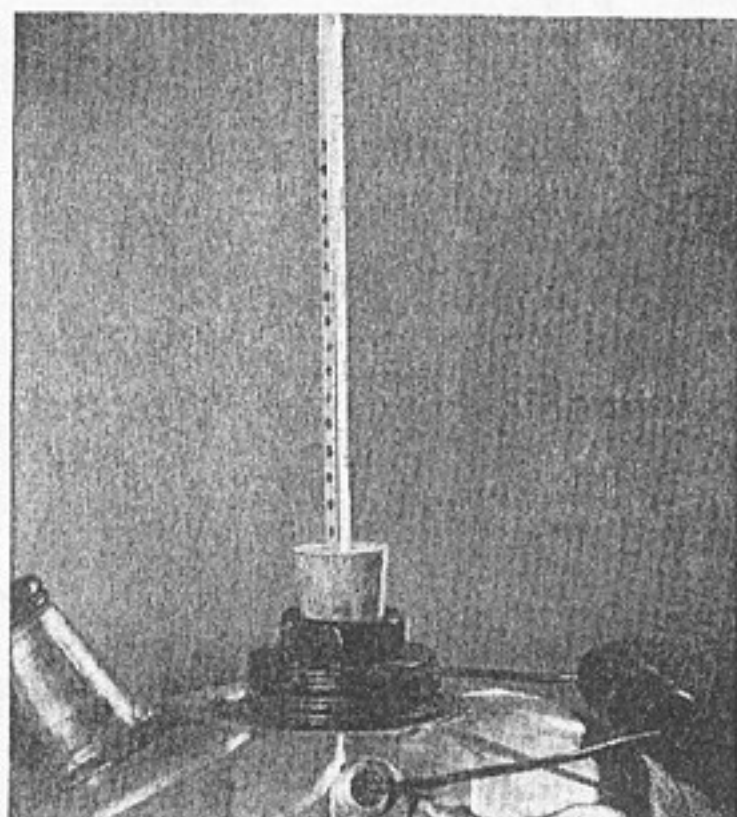
Popular Mechanics February 1958

By Walter E. Burton

HOBBYWORK



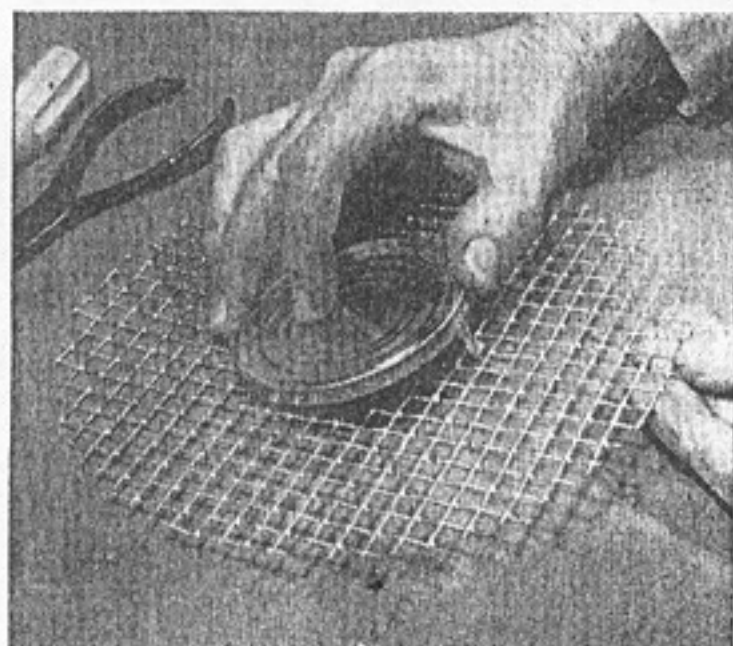
Legs of flat steel are attached with sheet-metal screws. Note the 2 3/4-in. opening in bottom of can



Temperature of the oven can be checked by inserting thermometer in cork and sticking in filler hole

DOZENS OF USES will be found for a drying oven in the workshop and hobby room. Not only will it prove handy during humid weather in speeding the drying of spray enamels, but its gentle warm-air circulation will hasten the drying of plaster casts, clay models, cemented bric-a-brac and small glued objects. Air entering through an opening in the bottom of the can is heated by a 100-watt lamp, rises and escapes through the uncapped spout and filler openings. With a 100-watt bulb, the oven maintains a temperature between 140 and 160 deg. F. Of course, less heat

Bottom from food can is hooked to hardware-cloth shelf to provide heat deflector and drip cup over lamp





can be had by using a smaller watt lamp.

As you can see, it is made primarily from a two-gal. gasoline or oil can which is provided with a hinged door, a hardware-cloth

Heat from 100-watt lamp bulb provides warm circulating air to speed drying of this cemented doll head



shelf and legs to support it over the lamp. A deflector cut from the bottom of a tin can is hung $\frac{1}{4}$ in. below the shelf and directly over the bulb to avoid a hot spot and to catch drips. The shelf rests on sheet-metal screws which are turned in through the side of the can a little below the door opening. When using the oven to dry lacquer or other finishes containing highly volatile solvents, leave the oven door open the first few moments to permit the solvent fumes to escape. Of course, there should be adequate room ventilation, too. ★ ★ ★

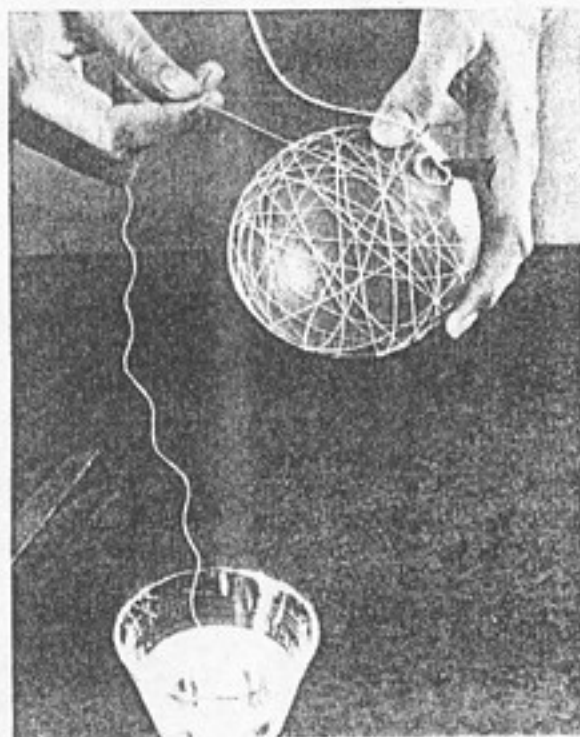
SUNSET DECEMBER, 1971

How to make thread balls

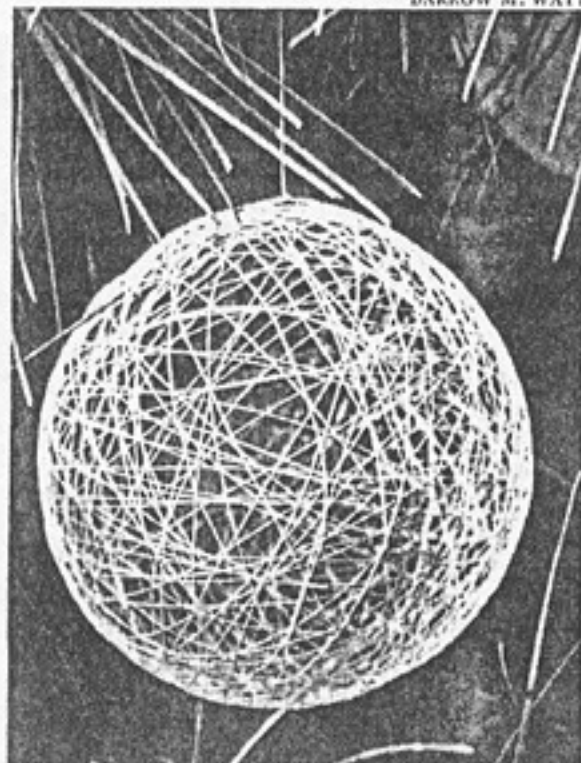
These lacy thread balls are made with inexpensive materials which you may already have around the house: balloons, thread, string, and liquid starch.

Suspend the balloon over a work surface. Place a spool of thread in a custard cup and cover it with liquid starch. Wind the thread around the balloon, but not so tightly that it cuts into the balloon. When you are finished, cut the thread and smooth it down.

After the ball has dried overnight, pop and remove the balloon. Hang the ball with thread from branches of the Christmas tree. □



Wind until desired effect is created



Starch-stiffened thread makes ornament

DARROW M. WATT

You wrap an inflated balloon with glue-soaked string

The twiny spherical lamp pictured at left is made by wrapping an inflated balloon with glue-soaked string. When the glue dries, you pop the balloon and remove it, then attach the electrical parts.

You can use almost any absorbent string for the shade: jute, which comes in natural shades of beige and brown, or rug yarn, which comes in a spectrum of colors. Avoid stiff materials like flax, which won't absorb enough glue to make the shade rigid.

Brass 3/4-inch-diameter vase caps keep the bulb safely away from the shade, but don't use a bulb bigger than 40 watts.

Materials. You need about 5 ounces of absorbent yarn or string, a round balloon that has about a 3-inch diameter before it's inflated, petroleum jelly, 8 ounces of white liquid glue, a can of fire-resistant spray, a bowl to hold the glue, and the electrical parts shown in the drawing. Materials cost about \$10.

Making the shade. Suspend the inflated balloon above newspapers to catch glue drippings. Wipe a thin film of petroleum jelly over the balloon.

Wind the yarn or string into a loose ball. Pour glue into bowl, diluting to about 1/3 water, 2/3 glue. Soak the string in the bowl a few minutes. With the ball of string still in the glue, take one end and slowly pull the whole length between your fingers to remove excess glue.

Stick one end of the string to the balloon, then wind all the string around it. Wrap as evenly as possible and leave a small oval space about 3 1/4 inches in diameter uncovered at the top; later, that's where you'll insert the light socket. Wrap as much string around the balloon as you wish, then cut it and tuck in the end. Let the string dry overnight before you pop and remove the balloon. Spray finished shade with fire retardant.

Wiring. Cut a length of number 2, round 18-2 SVT electrical cord the desired length. Following the drawing, connect

the cord's wires to a 1/8-inch threaded porcelain socket (letter "d" on drawing). Push the other end of the cord through

a 1/8 by 2 1/2-inch threaded brass nipple (a). Screw the nipple into the top of the porcelain socket and insert a 25 or 40-watt T-10 frosted bulb. Place bulb and socket in the shade.

Slip the bottom vase cap (c) onto the cord and slide it sideways through the oval opening.

Now slip the second vase cap onto the cord from the plug end until it rests on top of the shade. Pull back on the cord until the two vase caps sandwich the string shade between them. Slip a 1/8-inch brass finish nut (b) over the cord from the plug end and screw it onto the nipple to lock vase caps in place.

Attach a plug to the other end of the cord, and you're done. □

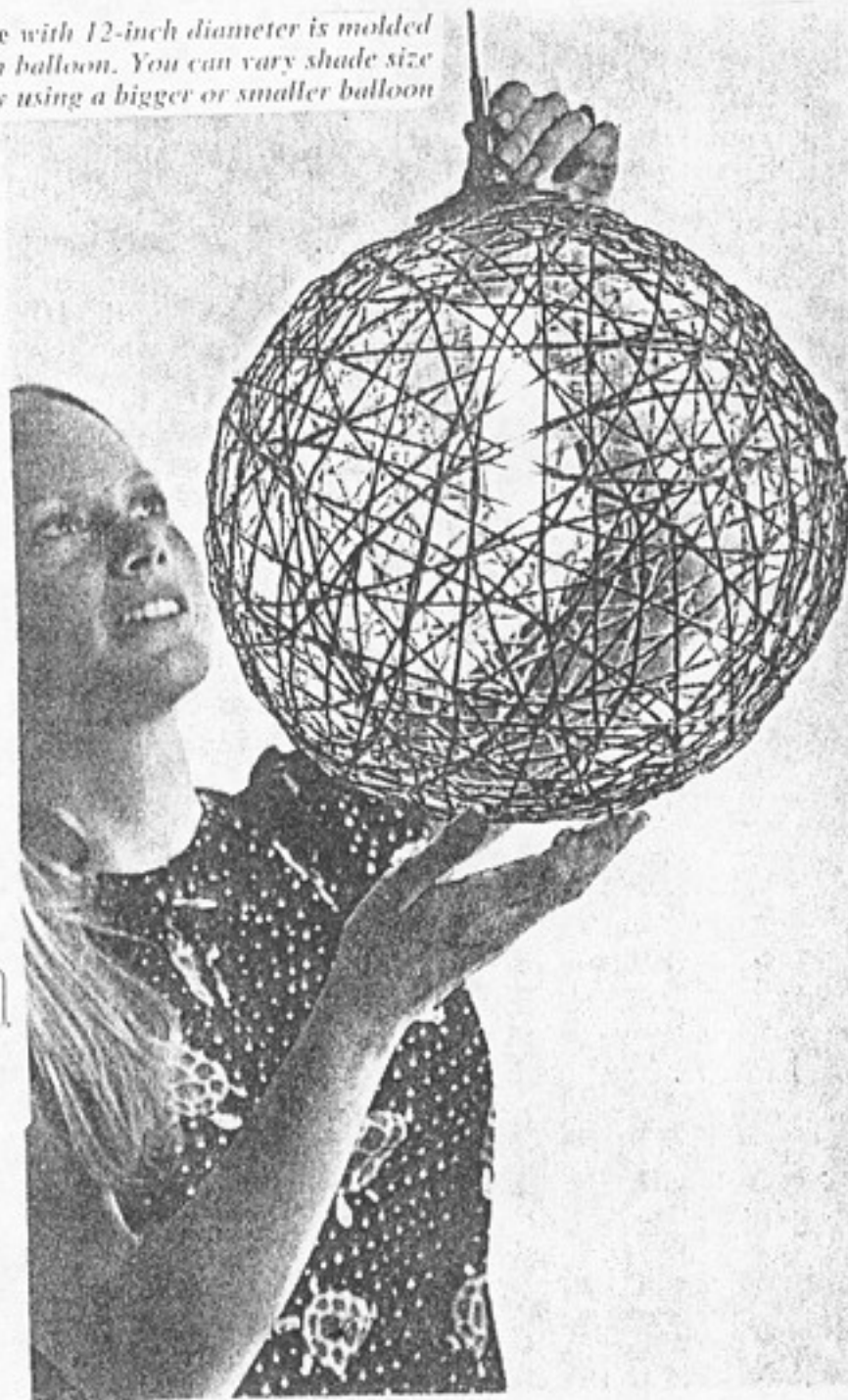
SUNSET NOVEMBER, 1972

Shade with 12-inch diameter is molded from balloon. You can vary shade size by using a bigger or smaller balloon

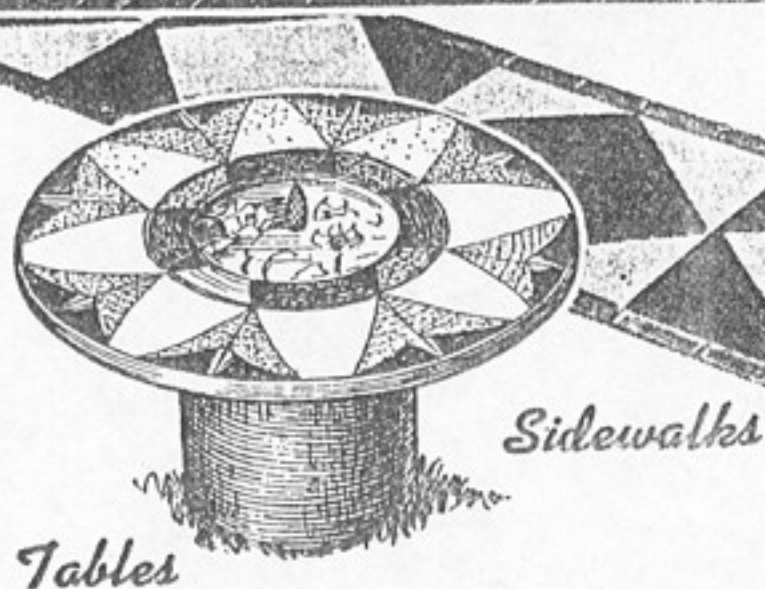
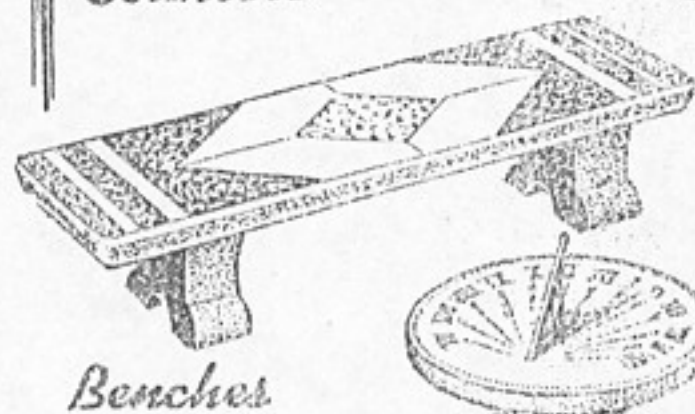
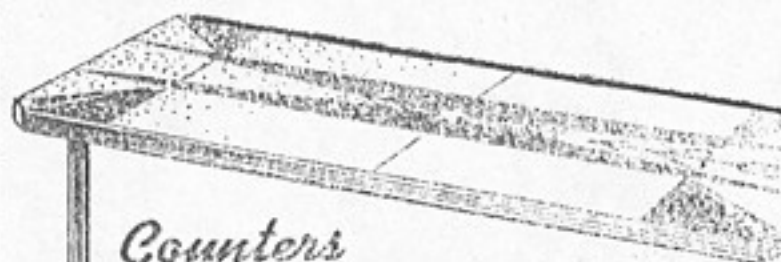
- a. Nipple
- b. Finish nut
- c. Vase caps
- d. Socket



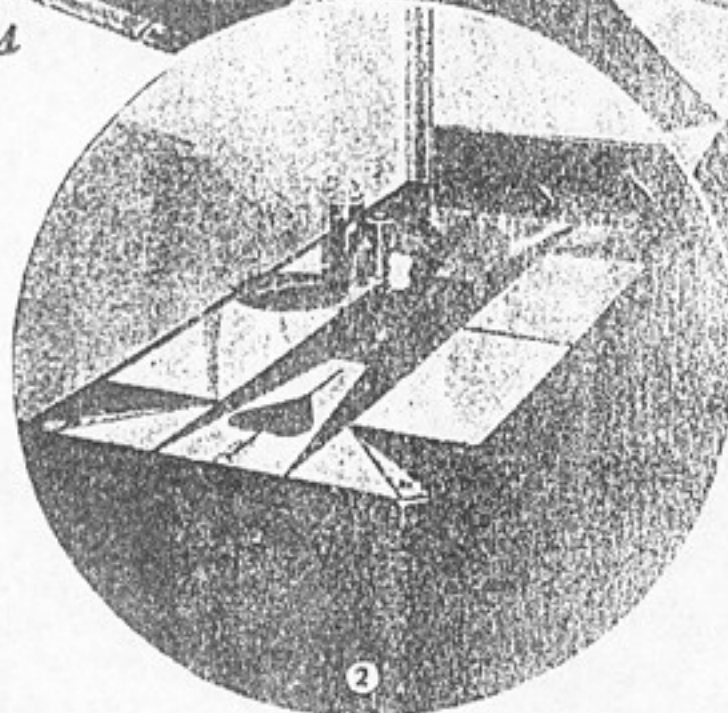
Winding string around balloon is easy, but a bit messy



TERRAZZO



Sidewalks

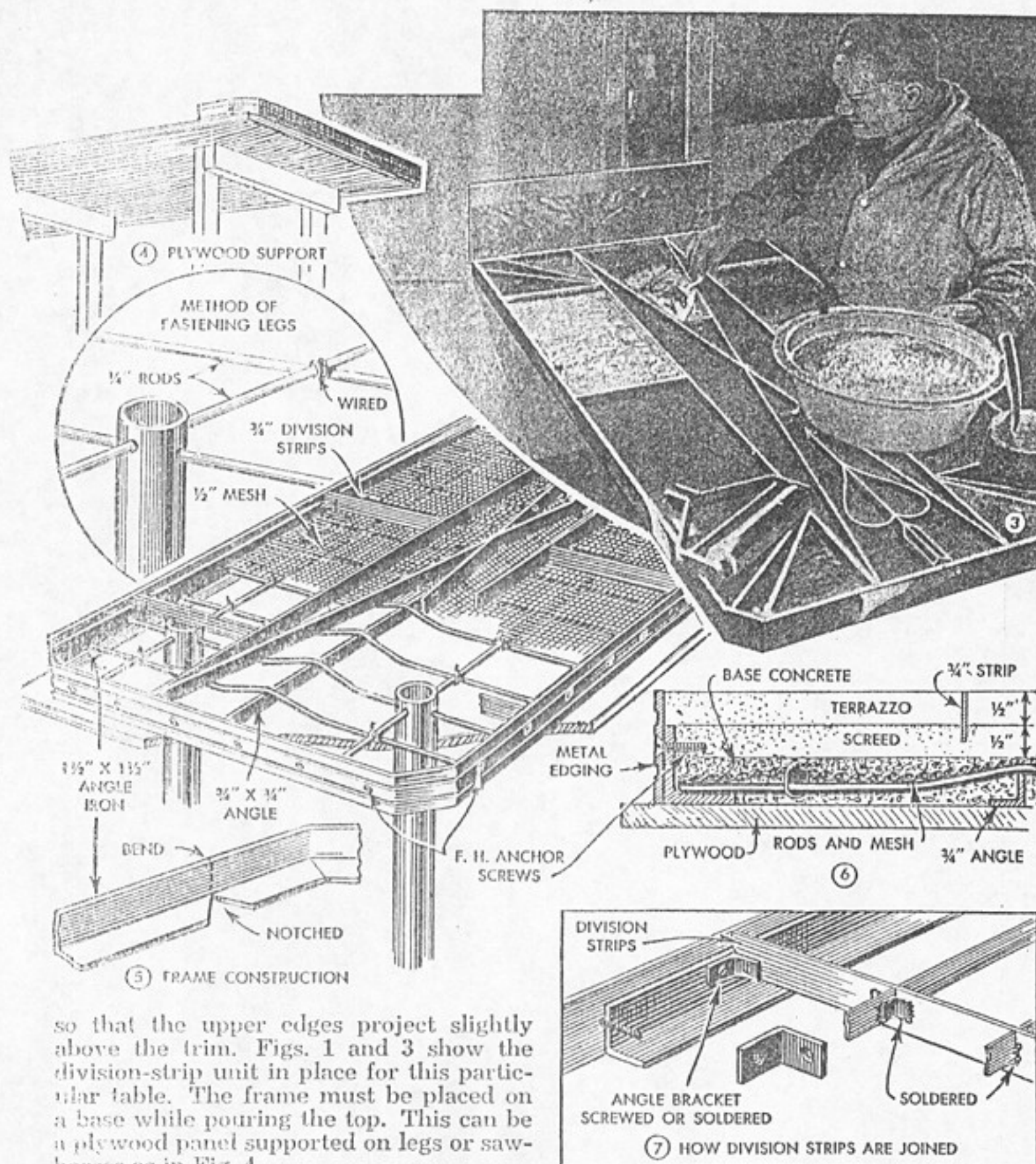


TERRAZZO, a mixture of cement and marble chips, provides a hard surface that is almost everlasting for use as table and counter tops, benches, sundials, sidewalks and many other surfaces subject to hard use or exposure to the weather. Use of cement-coloring materials permits countless color designs to be worked out in the finished surfaces.

Since terrazzo is applied like concrete, it is necessary that a form be used; either a removable one for precasting, or one that becomes part of the completed project. In the latter case the table pictured in Fig. 2 is a good example. Here the form is shaped from angle iron to form a frame as in Fig. 5. A piece of angle iron at the center of the frame supports the reinforcing rods, which are placed crosswise of the frame. Legs can be attached as desired, but one way is to use lengths of metal tubing, which are drilled at the upper end so that the reinforcing rods can be passed through them as in Fig. 5. This method helps provide rigidity, but does not permit removal of the legs. Next, wire mesh is placed over

the rods. Following this, a metal edging is screwed to the frame, the latter being drilled and tapped for the screws, which project inside and tend to anchor the terrazzo to the frame.

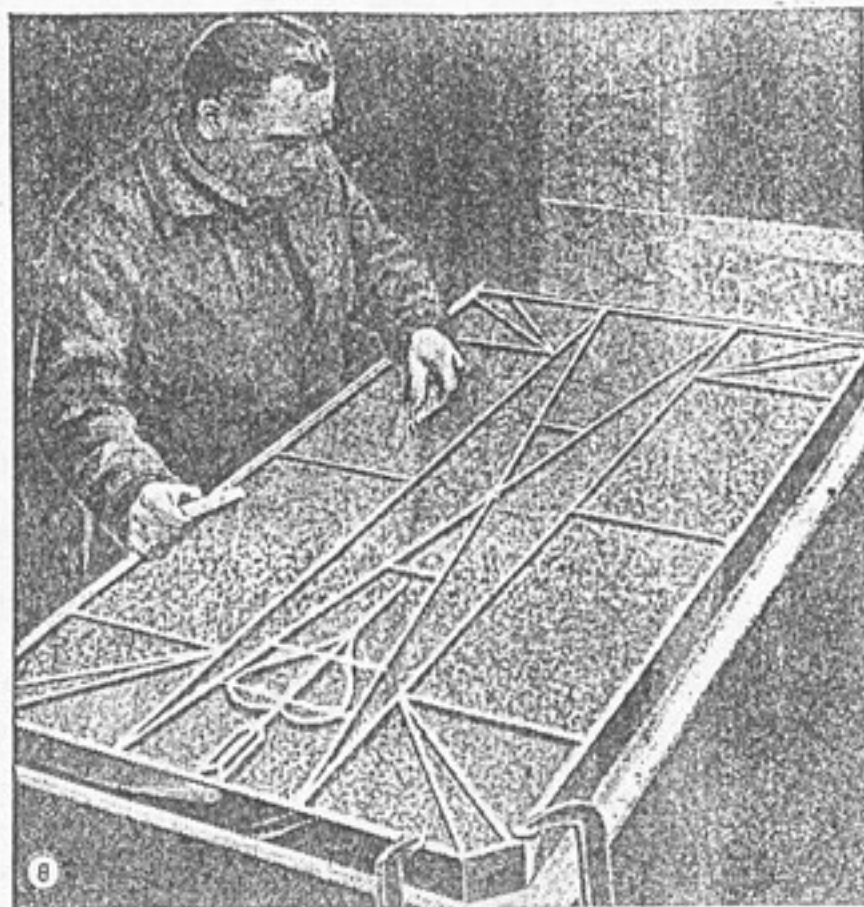
If a color design is to be used, strips of thin brass or other non-rusting metal are next installed to serve as division strips to keep the colors from mixing when the terrazzo is applied. Usually the strips are soldered together as in Fig. 7 to provide a single unit of the desired shape, which then is set in position and fastened in place



so that the upper edges project slightly above the trim. Figs. 1 and 3 show the division-strip unit in place for this particular table. The frame must be placed on a base while pouring the top. This can be a plywood panel supported on legs or saw-horses as in Fig. 4.

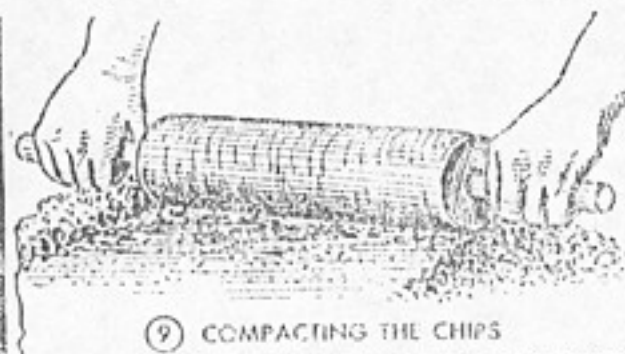
Now you are ready to pour the table top, which consists of a base layer of concrete, then a screed layer and finally the terrazzo, as indicated in Fig. 6. Formulas for mixing the various layers are given in the table under Fig. 8. Mix the ingredients for the base layer dry and then add water to produce a plastic that can be worked into the form. Proportion the thickness of the layers as in Fig. 6. After the base has set for a while, scratch the surface with a piece of wire mesh as in Fig. 8 and leave it overnight, covering it with damp burlap. Then scrape the roughened surface with the edge of a trowel and blow out all loose par-

ticles. A bellows or tire pump is ideal for this. Next, mix and apply a thick coat of grout and follow this immediately with a 1/2-in. layer of screed. If obtainable, add to each gallon of water used in mixing the grout a cup of Antihydro, a product for hastening the setting of concrete. Also, cover the base concrete with this water; let it stand for a few minutes and then soak up the surplus with a sponge. Trowel the screed well in between the division strips and level it. Scratch the screed layer and treat it exactly as you did the base layer. After applying the grout coat on the



FORMULAS	
Base concrete:	pea gravel, coarse clean sand, and cement, equal parts. Mix dry, then add water to make mix plastic enough to work easily.
Grout mix:	pure cement with enough water to bring to consistency of thick cream.
Screed mix:	coarse, clean sand, 2 parts; cement, 1 part; water to make thick paste.
Terrazzo:	white cement, 1 part; white or colored marble chips, 2 parts by volume; water to make stiff, workable mix.
Red cement:	oxide of iron, 1 part; white cement, 10 parts by volume. Mix dry, then moisten.
Separating compound:	stearic acid crystals and clean lard, equal parts. Mix together over medium fire. Apply hot with brush.

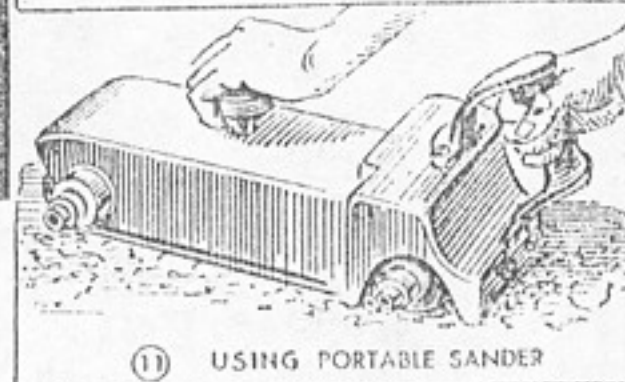
screed, you are ready to place one color of the terrazzo. White terrazzo is placed first; then each stronger color in succession. Black is always placed last. Start at the tight corners first. The idea is to have the marble chips packed evenly and as tightly as possible against each other. Let the terrazzo mount $\frac{1}{8}$ in. higher than the division strips. When all white portions of the design have been filled, trowel the terrazzo and let it set for a while. Then roll it as in Fig. 9 to squeeze out the surface cement, which is removed with a moist paintbrush. This process packs the marble chips evenly one against another. Let the terrazzo set an hour or so and then trowel repeatedly to a hard finish. When the terrazzo sets enough to feel hard to the touch, cover it carefully with clean waxed paper, then cover with damp burlap and let cure overnight. Burlap will stain terrazzo so be sure all surfaces are first covered with the waxed paper.



9 COMPACTING THE CHIPS



10 HAND-SURFACING



11 USING PORTABLE SANDER

The following morning soak all the work in Anti-hydro water after first having removed the waxed paper. Now mix the next color and proceed as before, following this procedure for each color to be applied. After the last color has been placed, cover the whole surface with waxed paper and moist burlap and let cure for six days. At the end of this time the terrazzo surface is ground down and polished.

There are two methods of grinding: the wet and the dry method. A flexible shaft grinder with a silicon-carbide rim wheel and a wet spindle head will do fast and fine work. Follow coarse wheels with progressively finer grades. Let the wheel move over the surface with an easy motion. Avoid grinding rings or holes in the surface. Follow this with a hand stone, Fig. 10; an ordinary carpenter's silicon-carbide stone is fine for this work.

A portable sander used as in Fig. 11 does good work as a dry grinder. However, one may grind entirely by hand, using a coarse silicon-carbide brick fitted with a handle and a finer oil stone for the polishing. While grinding, use clean water and a sponge to clean the surface so that you can observe your progress. Grind down the surface until it is free of scratches, then polish the metal parts in the pattern with

a fine hand stone. Follow this with a thorough cleansing with water.

Some air holes may have been left in the terrazzo through improper placing and rolling of the aggregates. These can be filled with a grout mix of the proper color. Cover the repaired parts with waxed paper and let cure overnight. Then grind again with a fine stone, grinding only enough to remove the surplus grout. Clean with several applications of water; sponge and let dry for 24 hrs. There are numerous preparations for waterproofing terrazzo and making it stainless. A readily available preparation is boiled linseed oil and turpentine mixed in equal parts. Apply to the dry terrazzo surface and wipe off all surplus. Repeat each day for three days as above. Let the final coat dry for 24 hrs. Follow with auto or furniture wax and bring to a polish.

When terrazzo is used outdoors where metal division strips and edging would not be satisfactory, or when the expenditure for metal is undesirable, the terrazzo can

be precast into blocks of the colors and shapes required and then assembled on a base. The terrazzo is cast in wooden forms of the size and shape desired and of uniform depth. The forms first must be varnished and coated with a separating compound to prevent the terrazzo from sticking to them, the compound being made as described in the formula table. Pouring and curing of the terrazzo in the forms is handled in the same way as was done for the table. When completed, the forms are removed and the surface and edges of the terrazzo blocks are ground and placed on a base consisting of concrete and screed built up as for the table, using reinforcing rods and wire mesh in a wooden form, which also must be varnished and coated with the separating compound. Before placing the terrazzo blocks, a grout coat is applied to the base and also between the joints after the blocks have been placed. Grinding and polishing of the terrazzo surface, after curing, completes the job.

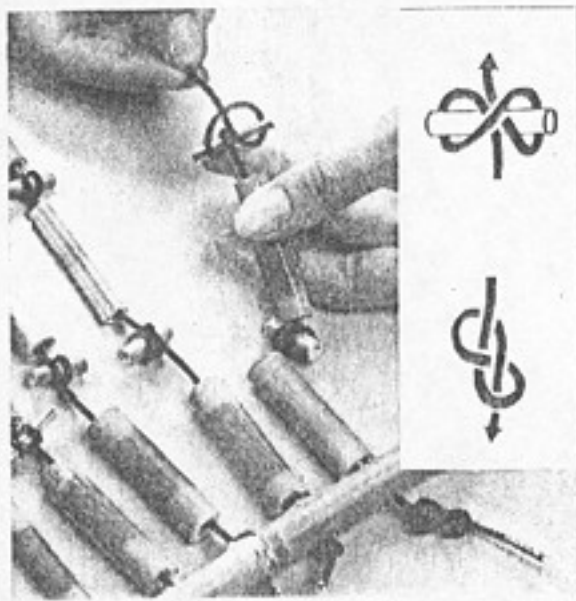
DARROW M. WATT

Through the bamboo curtain

SUNSET, 1969

Garden variety bamboo was used to make this beaded curtain.

It cost very little; we purchased two balls of chalk line at a hardware store and a package of cocoa brown fabric dye (which is optional) for a total of \$2.50.



Bamboo curtain is fun to make from garden trimmings; attractive indoors or out

Only two kinds of knots are used: clove hitch at each cross bead, figure 8 at end

Each 6-foot strand takes 12 feet of cord. Cut the necessary number of cord lengths—we hung a strand of beads every inch. If you plan to dye the cord, follow instructions on the dye package.

For the main beads, use stalks of bamboo about 1/2 inch in diameter, cut into 2-inch lengths; for the cross beads, use side shoots about 3/16 inch in diameter, cut into 3/4-inch lengths. Discard the joints (nodes). You can cut the small bamboo with pruning shears, but the larger pieces will require a power saw or fine-tooth hand saw.

Use one bamboo pole as a cross rod; drill holes through it at 1-inch intervals.

To make the pattern shown: Tie a large knot (such as a figure 8) in one end of a length of cord, thread the cord through the holes in the cross rod, and begin alternating vertical beads and cross beads. Tie each cross bead in place with a clove hitch, leaving about 1/2-inch play between the beads to give an airy effect. End each strand with a cross bead.

When the curtain is completed, hang the cross rod on screw hooks attached to the door frame.

Making your own fresh tortillas with a tortilla press

SUNSET FEBRUARY 1967

If you've ever tried to shape tortillas using the traditional pat-and-toss method of a practiced Mexican cook, you know how much dexterity this seemingly simple process requires.

With a hand-operated press like those used in Mexico in many small commercial tortilla bakeries, however, you can easily turn out corn tortillas that are uniformly thin and round.

The metal press shown in the photographs at right is the more sophisticated of two versions. Priced from \$3 to \$5, it is available from many Mexican groceries and specialty shops in the West.

If you like, you can make a wooden press that also turns out fine tortillas. Directions appear on page 117.

The dough from which corn tortillas are made couldn't be more simple. It requires but two ingredients: *masa* flour and warm water. The *masa* flour, packaged in 5 and 10-pound bags, is stocked by Mexican groceries and many supermarkets.

Fresh corn tortillas are a treat straight from the griddle, served warm with butter or a mild cheese. You can also refrigerate them for several days, sealed in plastic bags or wrapped in plastic film or foil; or freeze them in airtight packages.

Make corn tortillas to serve as a bread, or as the basis for tacos, enchiladas, and other Mexican dishes.

CORN TORTILLAS

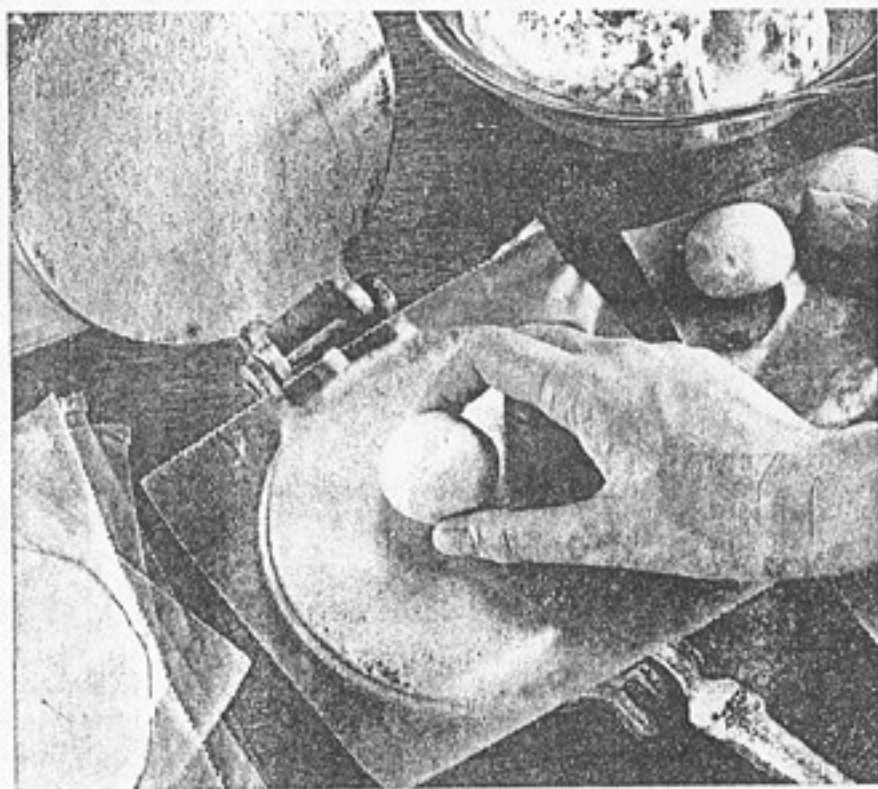
2 cups dehydrated *masa* flour (corn tortilla flour)

1½ cups warm water

Mix *masa* flour with warm water until dough holds together well. Using your hands, shape dough into a smooth ball. Divide dough into 12 equal-sized pieces, then roll each into a ball.

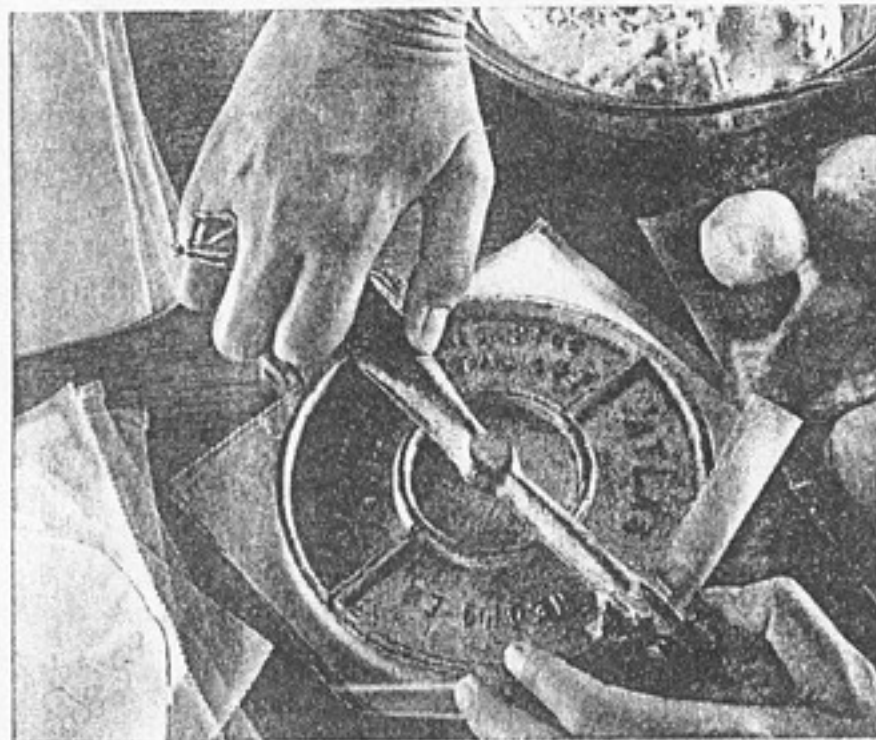
Place a square of waxed paper on bottom half of tortilla press; place 1 ball of dough, slightly off center toward the edge farthest from the handle, on the paper. Flatten it slightly with the palm of your hand. Cover with a second square of waxed paper. Lower top half of the press (being careful not to wrinkle the paper), and press down firmly on lever until the tortilla measures about 6 inches in diameter.

Peel off top piece of paper carefully. Invert the tortilla, paper side up, onto a preheated, ungreased, medium-hot griddle or into a heavy frying pan over medium-high heat. As the tortilla becomes warm, you will be able to peel off the remaining paper. Bake, turning frequently, until the tortilla looks dry and is lightly flecked with brown specks (it should still be soft), 1½ to 2 minutes. Serve tortillas warm, or cool and store, wrapped airtight. Makes 1 dozen 6-inch tortillas.

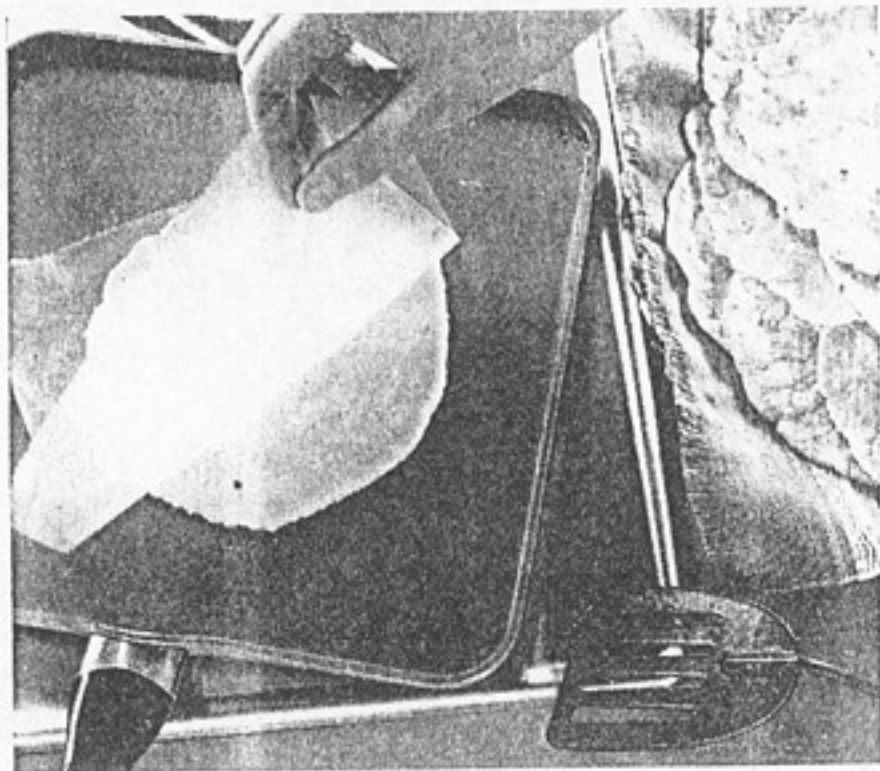


1. Place ball of tortilla dough, off center, on waxed paper on press; top with second square of paper to prevent sticking

DARROW M. WATT



2. Press slowly, firmly to flatten dough. Peel off top paper; leave tortilla on lower piece until ready to bake on griddle



3. Begin baking tortilla, paper side up; remove paper as tortilla starts to get hot. Turn often until dry, lightly browned

DARROW M. WATT

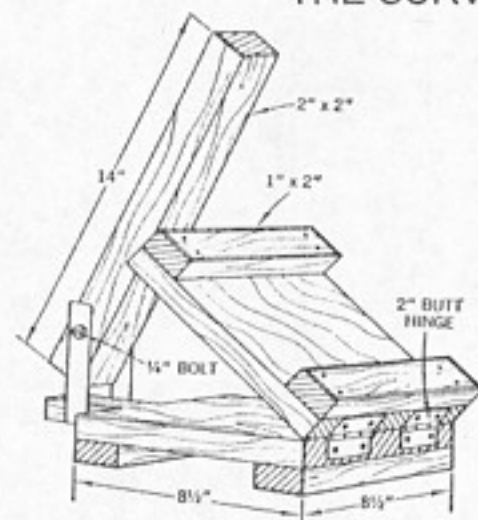


Tortillas are pressed out, uniformly flat, in this simple wooden Mexican-style press

*You can surprise
her with one*

This Mexican tortilla press works well and can be easily made from a few scraps of lumber. And the rougher your woodworking, the more authentic it looks.

For the press itself, use any $\frac{3}{4}$ to 1-inch-thick wood on hand, choosing unwarped boards that will fit together evenly. Cut the paddle-shaped bottom from an $8\frac{1}{2}$ by $12\frac{1}{2}$ inch piece, leaving a handle on one



Attach hinges securely with long screws. Use both glue and nails on 1 by 2's

end where you attach the 2 by 2 pressure arm. Glue and nail four 1 by 2 crosspieces to the top and bottom boards to help prevent warping when the press is washed.

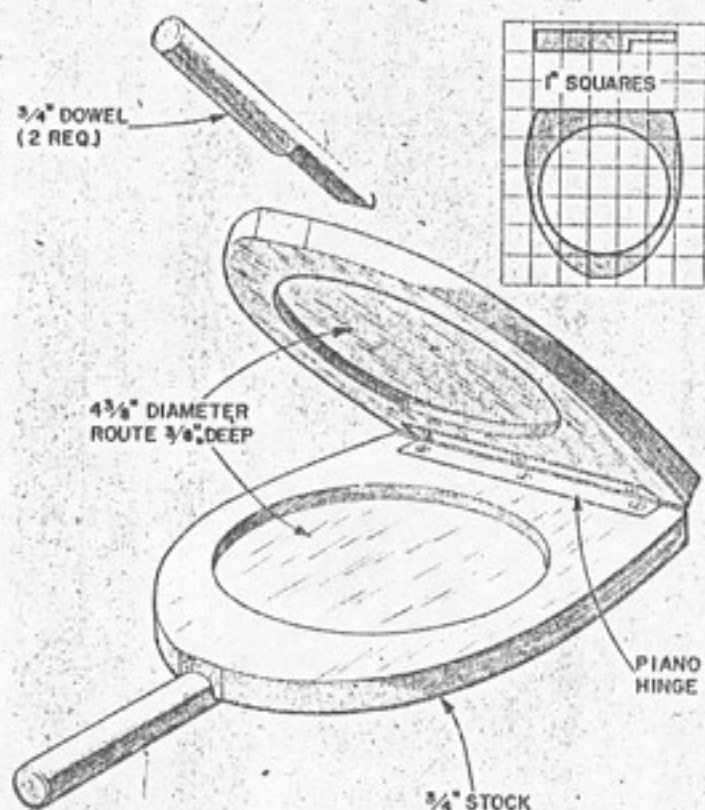
Last, locate the arm's $\frac{1}{4}$ -inch bolt at a height where the arm can lever down (not completely horizontally) over the top of the press.



Hamburger patties are placed in press and press is closed. The result: perfectly shaped, uniform hamburgers every time.

HAMBURGER PRESS -

By Milt Grassell and Del Blanchard



THIS unique hamburger press makes a useful present for your better half, a special gift for a friend, or a good item for beginning a spare-time profitable business. Whether you make just one or dozens, you will find the cost very low because the entire project can be made from scrap pieces that a person ordinarily discards. For each press, you'll need two $\frac{3}{4}$ x6x6-in. pieces of pine, maple, or other close-grained wood, two 5-in. lengths of $\frac{3}{4}$ -in. hardwood dowel, one 5-in. length of piano hinge, six $\frac{5}{8}$ -in. No. 5 flathead wood screws, and one decal purchased from the five-and-ten. The $\frac{3}{8}$ x4 $\frac{3}{8}$ -in. recess in each half of the press can be made with an expansion bit, on a lathe, or with a hand router. For real production, a hand router set in a simple jig will save a lot of time. •

SUNSET OCTOBER, 1961



These sweet pineapple tamales appear for breakfast. They are served warm with crisp bacon, scrambled eggs, and hot coffee



Typical Mexican dinner, this features chicken tamales, refried beans with shredded cheese, guacamole, and hot tortillas



Tamales de Dulces (tamales with a sweet caramel-like filling) are served like a pastry with milk, coffee, or chocolate

Make them ahead
and freeze them:

Mexican tamales

In Mexico, fresh tamales may appear at any meal of the day. The classic meat-filled tamale (*Tamale de Carne*)—usually served as a dinner entrée with a salad, vegetables, refried beans, and perhaps tortillas—has already worked its way into our Western menus. Less familiar

are the popular sweet tamales, with fruit or caramel-like fillings.

Tamales de Frutas are most often served at breakfast, along with eggs, ham, fresh fruit, and coffee. *Tamales de Dulces* (also called *Tamales de Caramelo*), are often served for the Mexican *cena*, the light

evening meal. They are also served as we serve a sweet roll for breakfast.

Tamales are not difficult to prepare, but they do require quite a lot of time. We recommend preparing them in quantity and storing them in the freezer, to be used as needed.

The recipes be-

low make 100 to 125 meat tamales, and 60 to 75 sweet or fruit tamales; the exact number depends on how much masa and filling you use for each tamale.

Mexican tamales are smaller and flatter than the typical California tamale. About three meat tamales or two sweet or fruit tamales make a serving.

BASIC METHOD FOR PREPARING TAMALES

All the types of tamales have the same appearance, and are made and cooked by the same methods, but the ingredients for the masa and fillings differ. The following general directions should be used in conjunction with each specific recipe.

There are three main parts to the tamale: A casing made of corn shucks that holds the tamale together; the masa, a coarse corn flour mixture; and a filling.

Assembling. You can purchase the corn shucks for the casings in plastic bags or in bulk in many grocery and specialty food stores which handle Mexican foods. You can also use fresh corn shucks or dry your own by leaving the green shucks in a warm, sunny spot for 3 to 8 days or until yellow; store in a dry place. (If corn shucks are not available, you can use 6 by 8-inch pieces of foil, clear plastic wrap, or polyethylene wrap for sandwiches.)

The day before you make tamales, trim ragged edges from shucks with scissors; wash shucks thoroughly. Don't worry about shucks that have split, as two small pieces can be overlapped and used as one. Soak the dry shucks overnight in water.

Masa flour—sometimes called corn tamale or corn tortilla flour—is available in 5-pound packages in some grocery or specialty food stores. Mix dough as directed in each specific recipe, and place $1\frac{1}{2}$ to 2 tablespoonfuls on each shuck. With a tablespoon, spread dough thinly out to the edges, leaving a $\frac{1}{2}$ -inch margin at the sides, and at least a 2-inch margin at the ends (ends will be folded under later).

Spoon filling (amount given in each recipe) along the center of masa. Bring side edges of the shuck together, overlapping slightly, and fold ends under (see photograph below). Some people like to tie a narrow strip ($\frac{1}{4}$ inch wide) of shuck lengthwise around the tamale to hold the folded ends flat.

Steaming. Once you have the tamales assembled, they are ready to steam. Place them on a steaming rack in layers, packing them loosely enough so steam can circulate freely, and put in large kettle or roasting pan that has about 2 inches of water in the bottom. Make certain the tamales won't touch the boiling water,

especially if you use clear plastic wrap.

(You can make a steaming rack for the kettle or roasting pan by shaping hardware cloth to pan's size and resting it on blocks or a similar device to hold it above the water.)

Place covered kettle over medium heat (water should boil gently.) Steam tamales for about 45 minutes. To test for doneness, remove a tamale from top and open shuck; if masa does not stick to shuck, it is ready to eat or to cool and wrap for freezing.

Freezing. Arrange tamales in neat stacks of about 6 on a rectangle of clear plastic wrap or foil. Wrap securely and seal with tape on which you record the date and type of tamale. To serve, reheat by steaming (as directed above) for 20 minutes. For best quality, use within 6 weeks.

TAMALES DE CARNE

Meat tamales can be filled with beef, pork, chicken, or turkey mixtures. We give recipes for pork and chicken fillings from Puebla, Mexico; the masa mixture is the same for both.

Masa for Meat Tamales • Beat $1\frac{1}{2}$ pounds lard (or 3 cups) until fluffy with electric mixer. Blend with a mixture of 12 cups of masa flour, 8 cups water, and $2\frac{1}{2}$ tablespoonfuls salt. Cover with a damp cloth until ready to use.

If Mexican stores or restaurants are in your vicinity, you may prefer to buy 5 pounds prepared masa, a dough, to use in place of the masa flour and water. Blend prepared masa with lard and salt and continue as directed.

Pork Filling • Cover 3 to 4 pounds pork loin with water seasoned with 3 tablespoonfuls chile powder and $1\frac{1}{2}$ teaspoons salt; simmer for about 20 minutes. Cut into small pieces and set aside. Sauté 1 large onion slice in 2 tablespoonfuls butter until transparent. Add 2 cans (6 oz. each) tomato paste and 2 tomato paste cans of water, 4 cloves mashed garlic, 1 tablespoonful curry powder and the pork pieces. Simmer for 10 minutes. Remove from

heat; remove onion slice. The sauce is ready to spoon on masa.

Chicken Filling • Stew 2 chickens (about 3 pounds each) in boiling salted water until tender. Cool; separate the meat into very small pieces. Mix 1 can ($2\frac{1}{4}$ oz.) sliced ripe olives, $\frac{3}{4}$ cup raisins, 1 finely chopped onion, 3 minced canned chiles jalapenos, 1 tablespoon of the juice from canned chile, and 1 teaspoon salt. Sauté in 2 tablespoonfuls salad oil until slightly browned. Add 2 cans (6 oz. each) tomato paste plus 2 tomato paste cans of water; simmer 10 minutes. Remove from heat; use to fill tamales as directed above.

TAMALES DE FRUTAS

Fruit tamales usually have fruit purée or minced fruit in the masa mixture and a filling of sweetened fruit or jam or preserves. You can combine fruit flavors by using the purée of one fruit in the masa and using another fruit for filling.

Masa for Fruit Tamales • Whip 1 cup lard in an electric mixer until light and fluffy. Blend in 3 cups masa flour, $1\frac{1}{4}$ cups fruit purée (peach, pineapple, or apricot), $\frac{1}{2}$ cup sugar, 1 teaspoon salt, and $1\frac{1}{2}$ teaspoons baking powder. Spread about $1\frac{1}{2}$ tablespoonfuls of masa mixture on prepared shuck (note photographs and general directions).

Fruit Fillings • If you use fresh fruit (peaches, pineapple, cherries, or banana), dice fruit and add about $\frac{1}{4}$ cup sugar for each cup of diced fruit. Use about 1 tablespoon of sweetened fruit for each tamale. If you use preserves or jam (we suggest strawberry, apricot, or pineapple), use about 1 tablespoon for each tamale.

Here are some fruit combinations you might try. Fill a peach purée masa with fresh cherries or banana, or with preserves of strawberry, apricot, or pineapple. Fill an apricot purée masa with fresh peaches or pineapple, or with strawberry preserves. Fill a pineapple purée masa with fresh banana, peaches, or cherries, or with strawberry or apricot preserves or jam.



Assembling the tamale: Hold a damp shuck in one hand; spread masa on the shuck, spread with spoon as shown. Place filling in center, bring sides of shucks together (just overlapping), fold ends under, place in steamer with folded ends tucked under

HOW to SMOKE FISH

by ROBERT PAGE LINCOLN

MODERN MECHANICS OCTOBER, 1935

SMOKED fish are a genuine delicacy and anyone can have all he desires by the expenditure of a little time and care in following the few directions given here. Many of our rough fish can be taken in the autumn or early winter and smoked most successfully. Suckers smoked in the autumn are in many ways comparable to whitefish.

In making a smokehouse suitable for smoking fish it need be no more than 6 feet in height, by about 4 feet square.

First put the fish in a salt pickle, the object of which is to take from the flesh of the fish all possible moisture. The fish is cleaned, cutting off the head and removing the entrails, and fins. The skin and scales of the fish are left intact. The fish is split down the spine, from the inside, in such fashion that the two sides may be laid out flat, but not so that the skin of the back is broken.

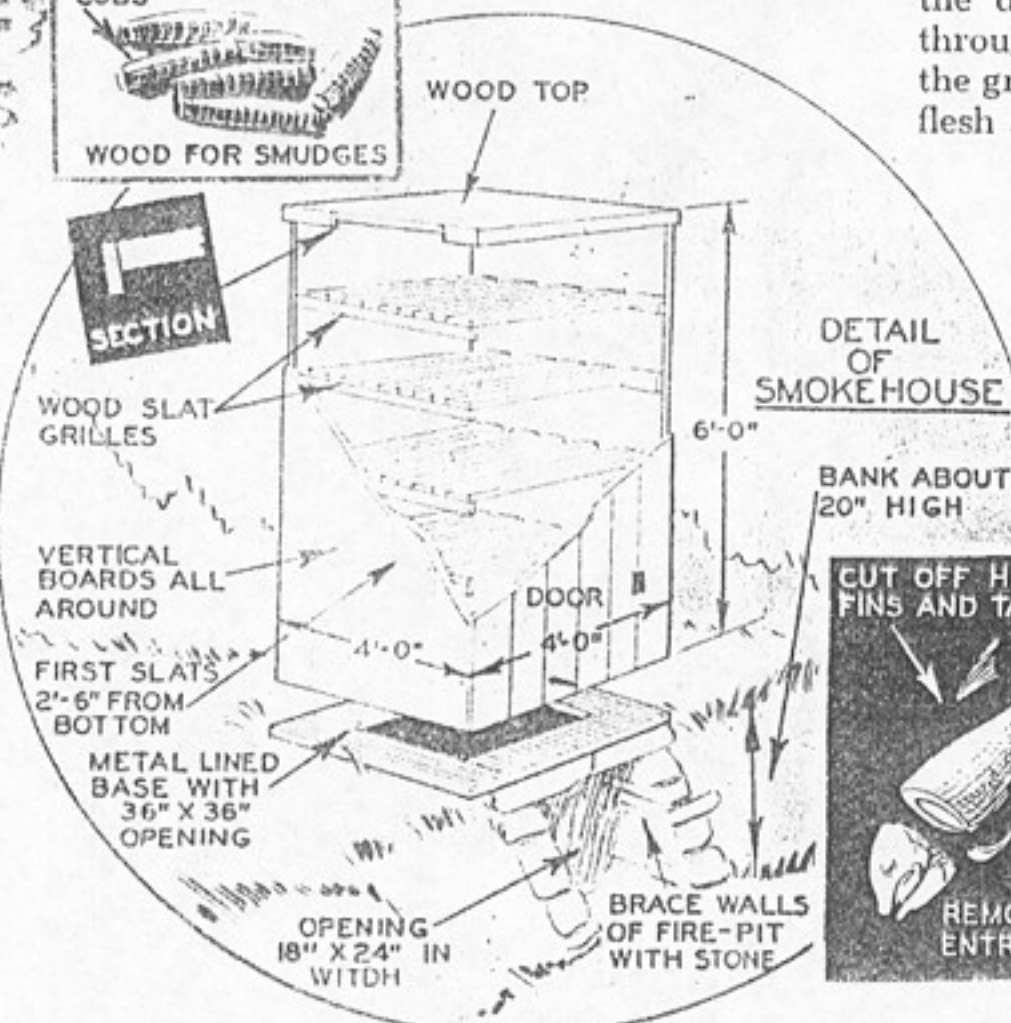
Drain the fish, wipe with a cloth, and then arrange them on the slats flesh side down. Start your smudge and through the first day smoke the fish. On the second day instead of a smudge, a hot fire is started in the fire-pit with dry hardwood, which is kept up through the day or as long as it takes to cook it through. The fire must be hot enough to bring the grease out of the fish. Do not keep the fish flesh side down during this cooking process.

Rather turn the skin side down. During the cooking process, try the fish with a sharp fork and see if the flesh comes away from the skin and bones in flakes. If so, you can be sure that it is done.

The cleaned body of the fish is soaked in brine for twenty-four hours before being smoked. Spread the sides of the fish out flat so that the flesh side can be laid down on racks.



In addition to smudge material shown at left cedar bark and wood can also be used. When building the smokehouse leave narrow cracks between the boards on the sides to permit some of the smoke to escape and to provide for circulation. The first day the fish are smoked and the second day cooked over a hot fire built in the pit. Set the house up on a small bank so that the fire pit can be reached without opening the door.



How to corn your own beef or pork

SUNSET FEBRUARY 1963

You may remember when a big barrel of meat being cured (or corned) was a familiar sight. Meat was corned then to preserve it for future use. Today meat is corned for only one reason—because we like the flavor.

A relatively simple pickling solution contributes the special flavor of corned meat. Especially if you're a connoisseur of these meats, we suggest you try corning some at home—just a small amount at a time in your refrigerator.

When you do it yourself, you can control the saltiness of the meat, cure it lightly or more heavily as you prefer, and vary the sweetness of the solution to suit your taste. Also, you can discover the flavors of some corned beef and pork cuts that are seldom, if ever, found in markets.

HOW TO CURE MEAT

Because you'll be keeping the meat in your refrigerator (temperature shouldn't go above 45°) for about one to two weeks while it is curing, start by sizing up your space. You'll need an enamel, earthenware, glass, or plastic (not metal) container large enough to contain the meat and enough brine to cover it completely—and enough room in your refrigerator to keep the container. A small crock, refrigerator vegetable crisper, or pottery bowl might be used.

Write down the dimensions of your container and take a ruler along when you go to the market to buy the meat (see suggested cuts, pages 161 and 163). You can do one or several pieces at a time. They can be almost any size, and you can have beef and pork cuts curing in the same brine—the only limitation being space for the meat to be completely immersed in the solution.

Our recipe for the brine is based on 1 gallon water; multiply or divide the recipe to make enough so the meat will be covered with about 1 inch of brine over top. The one unfamiliar ingredient, saltpeter (potassium nitrate), is available in drug stores. Its action is to preserve the meat's red color and to hasten the curing.

Once you've tasted the results, you may want to try more or less sugar in the recipe, or substitute molasses for all or part of the sugar when you make it again. Don't change the other proportions, however—saltiness is controlled by

the length of time you leave the meat in the solution.

Corning Brine

1½ pounds rock salt or ice cream salt
(2½ cups)
About ¾ pound brown sugar (1¼ to 2 cups,
firmly packed) or 2½ cups light molasses
1½ teaspoons soda
4 teaspoons powdered saltpeter
1 gallon water

In a large container, combine the salt, sugar, soda, and saltpeter. Heat 1 quart of the water to lukewarm and pour over salt mixture; stir until thoroughly dissolved. Add remaining 3 quarts (cold) water.

NOTE: In some areas in the West (usually rural communities) special curing salt is sold. Follow manufacturer's directions for preparing the curing brine, if you use it.

Preparing the meat

Wipe the meat clean with a damp cloth; completely thaw frozen meats. Use a metal skewer to punch holes deep into the meat on all sides. Put into the curing container. Pour over the corning brine until the meat begins to shift or float. Set a plate or clean board over the meat and set a clean stone or other weight on top to keep the meat submerged. Add more corning brine, if needed, to bring it to at least 1 inch above the top of the meat.

The length of time you leave the meat in this brine depends upon the size of the piece and how heavily or lightly cured you like it. Plan on about 1½ to 2 days curing per pound of meat—a 4 to 5-pound piece will be ready in a week to 10 days. About half-way through the curing time, turn the meat over and change its position.

You can cut a small slit into the center of the meat to check whether it has cured completely—there's a slight change in the color and texture of meat when cured. Once cured, the meat will keep from spoiling almost indefinitely if left in the brine, but it becomes increasingly salty. For best flavor, we suggest you keep it not more than 1 week after the curing is complete.

When you remove the meat from the brine, rinse it well in cool water and it is ready to cook in any way you usually cook corned meat. Keep the corned meat refrigerated and plan to cook it within a few days. (Corned meat loses some of its fine flavor and texture if frozen.) Discard

brine; it is best to start with fresh solution when you make more corned meat.

HOW TO COOK CORNED MEATS

Most recipes for corned meat begin with directions for cooking in water. The meat is delicious served plain, either hot or cold, perhaps with the addition of mustard, horse-radish, or chutney. Sometimes you may want to glaze cooked corned beef in the oven as you would a ham.

Basic cooking directions for corned meat follow. We also describe specific cuts of beef and pork to cure at home, with some special serving suggestions.

Basic cooking directions

Corned meats should be cooked long and slowly until the meat is very tender. You can accomplish this most quickly with a pressure cooker; or you can simmer the meat slowly on top of the range or in the oven. Before cooking, rinse the meat well, or soak it overnight in cool water if it is especially salty.

If you have a pressure cooker, follow the directions that come with the cooker for amount of water to use, pressure, and length of cooking time—a 4 or 5-pound piece usually takes about an hour in most cookers.

To simmer the corned meat, choose a large pan with a tightly fitting lid. If the meat is unevenly shaped, you might tie it into a compact piece. Put meat into the pan and cover with cold water. Bring to a boil, reduce heat, and simmer until the meat is tender. The time varies with the size and cut of meat, but plan on about 4 hours for a 4 to 5-pound piece. (Or instead of cooking it on top of your range, put the meat—covered with water and in a covered pan—into a 325° oven until tender.) Remove the meat from the cooking liquid and allow to cool about 15 minutes before slicing to serve hot.

To serve cold, drain the meat well and refrigerate. If it is a loose-textured meat, it's a good idea to shape it into an oblong (as nearly as possible), wrap in heavy foil, and weight down until well chilled. Cut in thin slices. A 5-pound piece makes about 8 to 10 servings.

CORNED BEEF

Many cuts make fine corned beef, and it is interesting that some of the least expensive are preferred for flavor. Most familiar is the brisket, which has a sweet, nutty flavor and loose, tender texture after it's cured and cooked. A trimmed brisket weighs 5 to 7 pounds, but you can buy a fresh piece of any size.

Eye of round is an attractive shape, fine for cutting and serving uniformly round—

slices. The meat is lean and compact in texture compared to brisket. Also try cross rib, rump, and other parts of the round.

Corned Beef Sandwich Luncheon. This menu will be featured in the March *Sunset*, along with a recipe for preparing corned beef with a spicy, red glaze.

Sugar-Glazed Corned Beef. This treatment, usually reserved for ham, is delicious on corned beef. Follow basic cooking directions; if this is done ahead, reheat the beef in the cooking broth just before glazing. Place the drained meat (a 4 or 5-lb. piece) in a shallow baking pan with fat side up. Score the fat diagonally; stud with whole cloves. Over the top sprinkle a mixture of $\frac{1}{4}$ cup brown sugar and $1\frac{1}{2}$ teaspoons dry mustard. Bake in a hot oven (400°) about 15 minutes or until glazed.

CORNED TONGUE

Large beef tongues are the ones most often available already corned. For a real taste treat, buy small, fresh tongue from a young beef or several lamb or veal tongues, and corn them yourself. When these are cured and cooked, they have a rich flavor, and are meltingly tender.

Follow basic cooking directions; a small beef tongue (about 4 lbs.) needs 3 to 4 hours to simmer until tender; lamb or veal tongues take $1\frac{1}{4}$ to $1\frac{3}{4}$ hours. Remove skin, and serve either hot or cold with prepared mustard or horse-radish.

You might make small open-face sandwiches for appetizers, using slices of corned lamb or veal tongue on rye or pumpernickel bread.

When you serve corned tongue as an entrée, this sauce is delicious with it:

Fresh Horse-radish Cream Sauce. Whip $\frac{1}{2}$ cup heavy cream until stiff. Fold in 1 teaspoon sugar, $\frac{1}{2}$ teaspoon lemon juice, and 1 to 2 tablespoons grated fresh horse-radish root or drained prepared horse-radish. Chill several hours. Makes 1 cup.

CORNED LEG OF PORK

A large whole leg of fresh pork weighing 14 to 16 pounds takes 2 weeks or longer to cure. A smaller and popular cut to corn is the butt end; a piece weighing about 5 pounds is ready to use in a week to 10 days. The flavor of corned pork is mild, and might be desired as an interesting cross between that of fresh pork and ham.

Follow the basic cooking directions on this page; corned pork takes about the same cooking time as corned beef (a piece of comparable size). You might serve the hot, cooked corned pork with chutney,

or with a mustard or fruit sauce such as is used for ham. Or try the following recipe for fruited corned pork—adapted from a corned beef recipe that has been a long-time favorite with *Sunset* readers:

Fruited Corned Pork. Cook a 5 or 6-pound piece of corned pork as directed in the basic cooking directions. Place the cooked and drained meat in a shallow baking dish with fat side up. Score the top and stud with whole cloves. Combine $\frac{1}{2}$ cup firmly packed brown sugar, $\frac{1}{4}$ cup fine dry bread crumbs, $\frac{1}{2}$ teaspoon dry mustard, grated peel of 1 orange, and grated peel of 1 lemon. Cover meat with this crumb mixture. Place in a moderately hot oven (375°) until slightly browned. Combine $\frac{1}{2}$ cup orange juice, 3 tablespoons lemon juice, and 1 cup cider; use to baste the meat frequently while you bake it 30 minutes longer.

CORNED SIDE OF PORK

The side is the part of the pork usually made into bacon. Your meat man may

Out of the oven...your own jerky

SUNSET SEPTEMBER 1971

To survive the grueling trek across the Sierra Nevada, Jedediah Smith and other "mountain men" often relied on leathery morsels of sun-dried meat they had carefully stored in their saddlebags days before.

Beef jerky is still a staple in the packs of today's mountain men—backpackers, skiers, and campers—and a popular snack for armchair sportsters, too.

In the modern version of this ancient method of preserving meat, your oven dries the thin, seasoned strips instead of the sun. The following recipe is for lean cuts of beef (flank, brisket, or round steak), venison, and the white meat of turkey or chicken.

You can also dry fully cooked ham (see separate directions). Because you start with smoked meat, ham jerky requires no additional seasoning from a marinade. Serve it as a snack to nibblers or crumble it to flavor or garnish other dishes as you would bits of bacon. (If the ham is quite salty, eating the ham jerky on a hike may make you thirsty.)

Partially freezing the meat before cutting makes it easier to slice evenly. Cut with the grain of the meat if you like a chewy jerky; cut across the grain for a more tender, brittle product.

This recipe makes the quantity of meat you can dry in one oven.

have to order it for you; ask for a *lean* piece of side pork. Cure it exactly the same as the other corned meats. It should be in the brine about a week; because it is a uniformly narrow piece, time is about the same regardless of whether you do a whole side or part of side.

Unlike the other corned meats, this one is not cooked in water until tender. We suggest you cook it this way to serve for breakfast or as a supper entrée with hashed browned potatoes.

Crisp Corned Side of Pork. Cut the corned pork side in $\frac{1}{4}$ -inch-thick slices, about like thickly sliced bacon. Put the slices into a pan and pour cold milk over them just to cover. Bring slowly to the boiling point; remove from heat. Lift the slices out of the milk with a fork and dip each one in flour to coat lightly each side. Arrange the slices on a rack in a baking pan and put into a hot oven (400°) until they are crisp and browned, about 20 to 25 minutes; turn once when half done.

Oven-Dried Jerky

- $1\frac{1}{2}$ to 2 pounds lean, boneless meat (see above), partially frozen
- $\frac{1}{4}$ cup soy sauce
- 1 tablespoon Worcestershire
- $\frac{1}{4}$ teaspoon each pepper and garlic powder
- $\frac{1}{2}$ teaspoon onion powder
- 1 teaspoon hickory smoke-flavored salt

Trim and discard all fat from meat (it becomes rancid quickly). Cut the meat in $\frac{1}{8}$ to $\frac{1}{4}$ -inch-thick slices (with or across the grain, as you wish). If necessary, cut large slices to make strips about $1\frac{1}{2}$ inches wide and as long as possible.

In a bowl combine the soy sauce, Worcestershire, pepper, garlic powder, onion powder, and smoke-flavored salt. Stir until seasonings are dissolved. Add meat strips and mix to thoroughly coat all surfaces. (Meat will absorb most of the liquid.) Let stand 1 hour, or cover and refrigerate overnight.

Shaking off any excess liquid, arrange strips of meat close together, but not overlapping, directly on the oven racks or on cake racks set in shallow, rimmed baking pans.

Dry meat at the lowest possible oven temperature (150° to 200°) until it has turned brown, feels hard, and is dry to the touch (about 5 hours for chicken and turkey, 4 to 7 hours for beef and

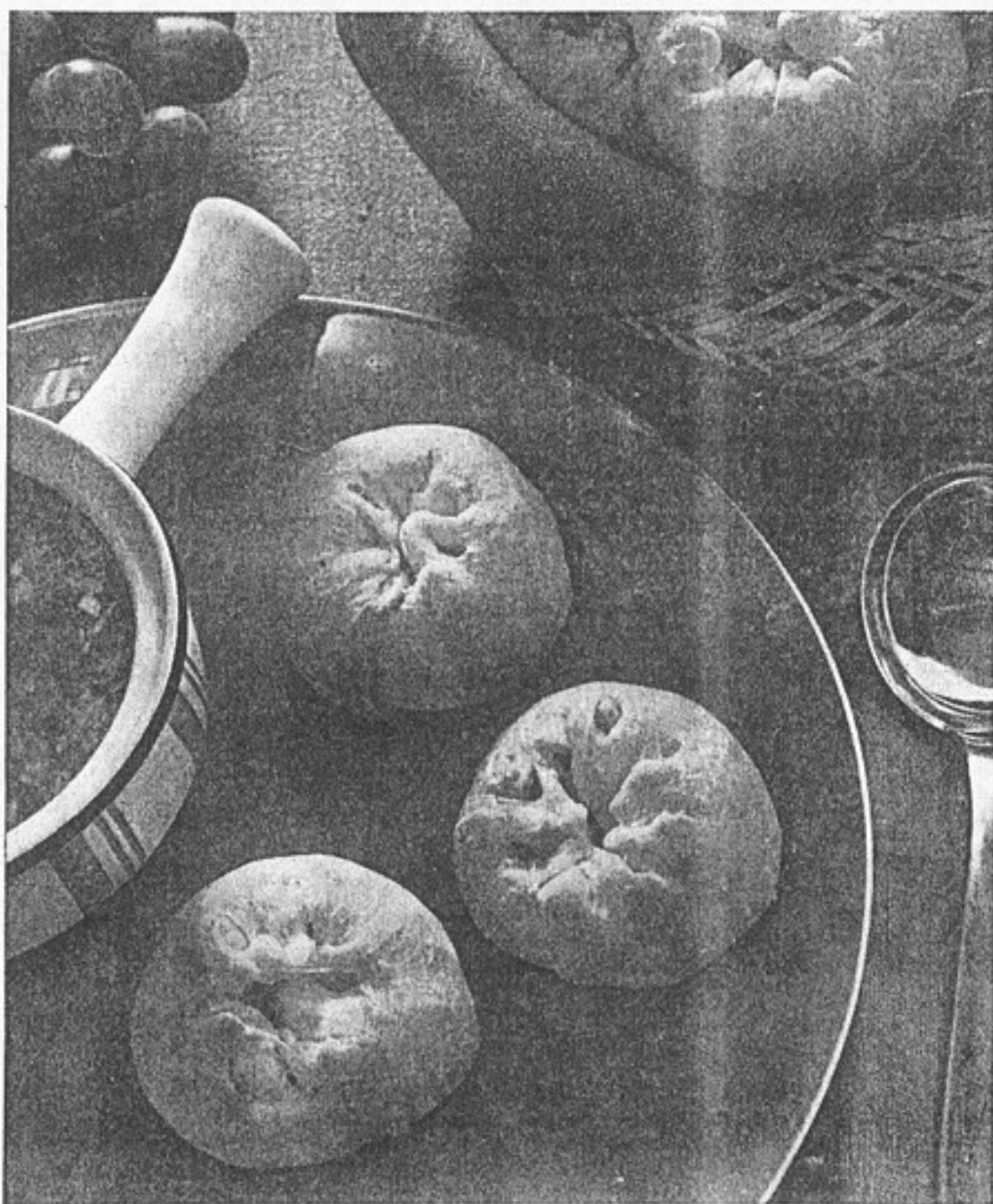
venison). Pat off any beads of oil. Let cool, then remove from racks and store airtight in plastic bags or in a jar with a tight-fitting lid.

Keep at cool room temperature or in the refrigerator until ready to use; it keeps indefinitely. Makes about ½ pound.—*M. C., Palo Alto, Calif.*

Oven-Dried Ham Jerky. Ask your meatman to slice 1½ to 2 pounds fully cooked, boneless ham ⅛ to ¼ inch thick. (Or you can slice leftover ham.) Trim and discard all fat. Cut the slices into strips about 1½ inches wide and

as long as possible. Lay ham strips close together, but not overlapping, directly on the oven racks or on cake racks set in shallow, rimmed baking pans. Dry ham at the lowest possible oven temperature (150° to 200°) until it feels hard and snaps readily (5 to 5½ hours). Pat off any beads of oil. Let cool, then remove from racks and store airtight in plastic bags or in a jar with a tight-fitting lid.

Keep at cool room temperature or in the refrigerator until ready to use; it keeps indefinitely. Makes about ½ pound.—*M. P., Santa Clara, Calif.*



Beef knishes, served hot, make for a hearty luncheon entrée with vegetable soup and fresh fruit to complete the menu. The knishes can also be filled with liver, or in slightly different form, a combination of cream and cottage cheeses with sautéed onion



Apply the knish filling in a long strip, roll dough around it three times, and repeat this process until you use all the dough

Almost every cuisine includes a distinctive meat-filled pastry—some savory combination that is baked, boiled, or fried. Among those that readily come to mind are the Cornish pasty, Polish pierogi, and English pork pie. And in Jewish cooking, the equivalent is the knish (the *k* is sounded). Because knish-making is a rather involved operation, it seems worthwhile to make a sizeable quantity, and freeze those that aren't eaten at once. For that reason the recipe which follows (page 220) makes four dozen.

Depending on their size, knishes can be served as an appetizer or a main dish. The larger knishes are often served with soup for a stick-to-the-ribs luncheon or supper. Meat-filled knishes complement a vegetable soup; cheese knishes are traditionally topped with sour cream and accompanied

by beet borscht. Small beef or liver knishes are tasty hors d'oeuvres.

Knishes can be made from any of several varieties of dough. Some use flaky pastry, others a biscuitlike dough or a potato dough. We have chosen a yeast dough for its lightness and flavor, and because it freezes well. It is also easier to roll out to the required thinness because of its elasticity.

The chicken fat (*schmaltz*) that gives knishes so much flavor and the dough a rich golden color can be obtained from most meat dealers on order. (You can substitute melted butter or salad oil if you wish.) Cut the chicken fat into pieces and place it in a pan over low heat until most of the fat is melted and only small crisp pieces remain, then strain the fat through cheesecloth or a fine strainer. A half pound of chicken fat as purchased will give about 1 cup of melted fat.

You can prepare in advance to bake knishes. Make any of the fillings a day

Knishes by the dozen

ahead and refrigerate them. The night before you plan to bake the knishes, make the dough up to the point of the first rising. Placed in a covered, greased bowl, it will rise slowly overnight in the refrigerator and be ready to use in the morning.

YEAST KNISHES

- 1 tablespoon sugar
- $\frac{3}{4}$ cup warm water (lukewarm for compressed yeast)
- $\frac{1}{2}$ teaspoon salt
- $\frac{1}{4}$ cup melted chicken fat or salad oil
- 1 package yeast, active dry or compressed
- 2 eggs, slightly beaten
- $3\frac{3}{4}$ cups unsifted flour
- Melted chicken fat or butter
- Beef, liver, or cheese filling (recipes follow)

Dissolve sugar in the water. Add salt, melted fat, and yeast, and let stand until yeast is softened, about 5 minutes. Stir in eggs, then flour, blending in the flour a little at a time to make a soft dough. Turn dough out on a lightly floured board and knead until smooth and elastic, about 10 minutes, adding more flour as necessary. Place the dough in a greased bowl, cover, and let it stand in a warm place until doubled, about 1 hour.

Punch the dough down, then roll it out very thinly on a lightly floured board to form a large rectangle about 15 by 21 inches and about $\frac{1}{8}$ inch in thickness. Brush the dough with melted chicken fat. Place a row of filling about 1 inch from the edge of the dough, using about 2 cups of the filling (for appetizer-sized knishes, use only 1 cup of the filling for each row). Roll up the dough as for a jelly roll, making three complete turns (see photograph, page 219). Cut off dough parallel with the roll, and repeat the filling process twice more until all the dough is used. Cut each

filled roll into 1-inch pieces. Stretch dough up over cut edges and seal in center to enclose filling (see photograph, left).

Brush the knishes with melted fat; place on greased baking sheets about $\frac{3}{4}$ inch apart. Let rise about 30 minutes. Bake in a moderately hot oven (375°) for about 25 minutes or until knishes are golden. Makes about 4 dozen 2-inch or 8 dozen $1\frac{1}{4}$ -inch knishes. To reheat frozen foil-wrapped knishes, take directly from freezer and place in a moderate oven (350°) for about 45 minutes.

Beef filling. Sauté 2 cups chopped onions in 2 tablespoons melted shortening or salad oil until soft and golden. Blend cooked onions with $2\frac{1}{2}$ cups mashed cooked potatoes, 1 tablespoon salt, $\frac{1}{4}$ teaspoon pepper, 5 cups ground cooked beef, and 1 egg, blending well. Makes about 6 cups filling.

Liver filling. Cut $1\frac{1}{2}$ pounds raw beef liver into strips; sauté with 2 cups chopped onion in about $\frac{1}{4}$ cup melted shortening or salad oil for about 10 minutes, reserving pan drippings. Grind the cooked mix-

ture using medium blade of food chopper. Mix in $2\frac{1}{2}$ cups mashed cooked potatoes, 1 tablespoon salt, $\frac{1}{4}$ teaspoon pepper, 1 egg, and pan drippings.

Cheese filling. Slice 2 medium-sized onions and sauté in 2 tablespoons butter or margarine until soft and golden; add 1 tablespoon sugar and continue cooking until onions are nicely browned; cool the onion mixture. Soften 2 packages (3 oz. each) cream cheese, and gradually beat in 3 cups dry curd cottage cheese (ask your grocer to order this cheese for you). Blend in 1 egg, 1 tablespoon flour, 1 teaspoon salt, and the cooled onion mixture. Shape cheese knishes by spreading the entire amount of cheese filling over the large rectangle of dough; then cut dough into three rectangles, each measuring about 15 by 8 inches.

Starting on long edge, roll each as a jelly roll; cut into 1-inch slices. Place, cut sides up, in a greased 13 by 9-inch baking pan about $\frac{1}{2}$ inch apart. Brush with fat, let rise, and bake as previously directed.—E.G., Palo Alto, Calif.

Chinese jerky is moister and less brittle than cowboy jerky

SUNSET JULY, 1977

The reason for this difference in texture lies in the way Chinese jerky is prepared. The meat is cooked first in two stages, eliminating the extensive drying that most uncooked jerky requires.

First, you cut the meat into large chunks and simmer it in a sweetly spiced soy mixture for a short time, then cool and chill it. This initial cooking makes it easier to slice the meat thinly and also helps prevent the pieces from curling up. After slicing, you return the meat to the seasoning liquid and cook it until all the liquid is absorbed.

After this precooking, drying the meat in a moderately hot oven for a short time preserves it enough so you can keep it moist and tender for several months in the refrigerator. If you prefer it drier and less perishable at room temperature, you can dry the meat at a lower oven temperature for a longer time until it's to your liking.

The cooking liquid for Chinese jerky is aromatic with cinnamon and star anise, a distinctive star-shaped spice found in Oriental grocery stores (if it's not available, use the alternative mentioned in the recipe that follows). You can also vary

the basic sweet soy flavor with hot chiles or curry powder.

Chinese Beef Jerky

Trim off all excess fat from 3 pounds lean boneless beef such as rump or sirloin tip. Cut meat lengthwise into long strips about 3 inches thick and wide.

In a 12-inch frying pan, combine 2 cups water, $\frac{1}{3}$ cup soy sauce, 1 tablespoon red wine or dry Sherry, $\frac{1}{4}$ cup sugar, 1 teaspoon salt, 2 whole star anise or equivalent broken pieces (or omit star anise and use 5 whole allspice and $\frac{3}{4}$ teaspoon anise seed), 5 thin slices of fresh ginger (each about 1 inch in diameter), and 2 whole green onions. If desired, also add either 3 to 4 small dried hot chile peppers or 1 tablespoon curry powder.

Bring mixture to a boil, then add meat; cover and simmer, turning meat occasionally, until firm, 20 to 30 minutes. Remove from cooking liquid, cool, and chill at least 1 hour or until cool and firm or up to overnight. Reserve cooking liquid.

Thinly slice the cold meat across the grain. Return meat slices to cooking liquid. Cook, uncovered, over medium to medium-high heat, turning meat pieces

BARROW M. WALT



Cut roll of filled dough into slices, then stretch dough across the center of each slice and seal it to enclose the filling

occasionally, until all liquid is absorbed (lower heat and turn meat more frequently as liquid is absorbed); it takes 40 to 50 minutes. Discard onion, ginger, and whole spices.

For moist-style beef jerky. Arrange strips of meat slightly apart in a single layer on cooky sheets. Bake, uncovered, in a 300° oven until dry to the touch but still pliable, 20 to 25 minutes. Pat any beads of oil off with paper towels. Let cool thoroughly. Store airtight in plastic bags or containers. You can keep the jerky up to 2 months in the refrigerator or for a few days stored at cool room

temperature.

For drier jerky. Arrange strips of meat close together but not overlapping on oven racks or on cake racks set in shallow-rimmed baking pans. Bake meat at the lowest possible oven temperature (150° to 200°) until it is dry to the touch but still slightly pliable, 3 to 5 hours. Pat any beads of oil off with paper towels. Let cool thoroughly. Store the jerky airtight in plastic bags or containers. Keep at cool room temperature or in the refrigerator as long as 6 months. Makes about 1 pound jerky.—*L.C., San Luis Obispo, Calif.* □

The centuries-old art of meat pickling

We present a rediscovery with beef, pork, or lamb

SUNSET OCTOBER, 1970

In the days before refrigeration, a pickling bath was used to preserve and revitalize meats. Today there's no longer any such need, but many people still like the sprightly flavor of meat that has been treated in this fashion.

Meat pickling deserves rediscovery, and happily it couldn't be simpler.

The centuries-old European method calls for immersing large meat cuts for several days in a wine vinegar-based marinade. Then the meat is braised or oven-roasted and served with a sauce enhanced by some of the marinating juices.

German sauerbraten, with its endless variations, is undoubtedly the best known pickled meat. Our Western modification is fragrant with herbs and streamlined in calories. Scandinavians prefer to pickle game or pork in a wine-plus-vinegar bath. In our Swedish recipe, pork loin is finished with gravy that is flavored with gjetost (yag-toast), a caramel-like goat cheese. Our third recipe marinates lamb in the French manner, dunked in a garlicky red wine solution; after roasting, currant jelly enhances the pan juices.

For any of the three recipes that follow, choose a container (a stainless steel, ceramic, or glass bowl, pan, or crock) just a little larger and deeper than the meat so the marinade covers it completely.

GERMAN SAUERBRATEN

- 6 pound boneless beef rump roast
- Wine vinegar marinade (recipe follows)
- 1 slice bacon, diced
- 1 carrot, diced
- 1 medium-sized onion, sliced
- 1 can (10½ oz.) condensed beef broth (undiluted)
- 3 tablespoons cornstarch blended with 3 tablespoons cold water
- ¾ cup sour cream
- Poached sliced apples (optional)

Place meat in a large bowl or pan and pour over wine vinegar marinade. Cover and chill for 3 to 4 days, turning meat over daily. Remove roast from marinade and pat dry. Heat bacon in a large Dutch oven; when drippings form, put in roast and brown on all sides. Add the carrot, onion, broth, and ½ cup of the marinade; cover and simmer 2½ to 3 hours, or until tender when pierced with a fork. Remove meat to a platter.

Strain juices, discarding residue, and bring to a boil. Blend in the paste of cornstarch and water and cook, stirring, until thickened. Stir some of the sauce into the sour cream, return to pan, and heat until hot through. Turn into a sauce bowl.

Thinly slice meat across the grain and serve with sour cream gravy and poached sliced apples, if you wish. Makes about 12 servings.—*G. L., San Francisco.*

Wine vinegar marinade. Combine 1 bottle (12 oz. or 1½ cups) white wine vinegar, 3 cups water, 1 bay leaf, 6 whole cloves, 2 teaspoons salt, ¼ teaspoon pepper, 1 teaspoon Italian seasoning (or mixture of ¼ teaspoon each rosemary, marjoram, sweet basil, and oregano); 1 carrot, diced; 1 stalk celery, cut up; 1 medium-sized onion, sliced; and 1 leek, sliced.

SWEDISH PICKLED PORK

- 5 pound boneless pork loin roast (rolled and tied)
- White wine marinade (recipe follows)
- 1 can (14 oz.) regular strength beef broth
- 1 tablespoon cornstarch blended with 1 tablespoon cold water
- 2 tablespoons currant jelly
- ¼ cup (1 oz.) shredded gjetost cheese
- ½ cup sour cream
- ½ pound small mushrooms
- 2 tablespoons butter or margarine

Place meat in a large bowl or pan and pour over the white wine marinade. Cover and chill for 3 to 4 days, turning daily. Remove roast from marinade and pat dry. Pour 1 cup of the marinade into a roasting pan and place meat on a rack in the pan. Insert meat thermometer in the thickest central portion of the roast. Roast, uncovered, in a 325° oven until temperature registers 170°, about 2½ hours. Transfer roast to a carving board and keep warm.

Skim fat from pan juices and strain into a saucepan. Add broth and bring to a boil. Stir in a paste of cornstarch and water; stirring, cook until thickened. Add jelly and cheese and heat, stirring, until smooth. Stir some of the sauce into the sour cream; return to pan and heat just until hot through, stirring. Turn into bowl.

Meanwhile, sauté mushrooms in butter just until moist and shiny and spoon around meat. Carve meat into thick slices and serve with sautéed mushrooms and gravy. Makes about 10 servings.

White wine marinade. Combine 1 bottle (¾ quart) dry white wine, ¾ cup white wine vinegar, 2 teaspoons salt, 1 tablespoon sugar, 1 teaspoon thyme, 1 bay leaf, 6 each whole cloves and whole allspice, 2 tablespoons olive oil, and 1 medium-sized onion, sliced.

FRENCH WINE-BATHED LAMB

- 4½-pound boned, rolled, and tied leg of lamb
- Red wine marinade (recipe follows)
- 1 cup water
- 2 tablespoons currant jelly
- Green grapes for garnish

Place meat in a large bowl or pan and pour over the red wine marinade. Cover and chill for 3 or 4 days, turning meat over daily. Remove meat from marinade and pat dry. Place on a rack in a roasting pan and insert meat thermometer in the central portion of the roast. Roast, uncovered, in a 325° oven until meat thermometer registers 160° for medium rare meat, about 2½ hours. Transfer roast to a carving board and keep warm.

Skim fat from pan drippings and discard. Then pour water into drippings and scrape up. Pour ½ cup of the marinade into a saucepan and cook down until reduced to ¼ cup; add the pan drippings and jelly and heat until blended smoothly. Turn into a sauce bowl. Garnish platter with bunches of grapes. Makes about 10 servings.

Red wine marinade. Combine 1 bottle (¾ quart) red wine, ¾ cup red wine vinegar, 2 tablespoons olive oil, 1 bay leaf, 1 teaspoon each rosemary and marjoram, 2 teaspoons salt, ½ teaspoon whole black peppers, and 1 medium-sized onion, sliced.

The wonderful sausage you make at home

The do-it-yourself way of modern life is reviving many a skill of our grandparents—and this is true in the kitchen as well as the workshop. Home-frozen ice cream, homemade bread, and home-smoked fish are examples. Now Western cooks are finding that sausage is easy and fun to make, and delicious to eat.

Ordinary kitchen equipment is all you need for sausage-making, though a stuffing machine helps if you are making large quantities. However, sausages don't freeze well for longer than a few weeks, so it is better to make only a small quantity at a time.

There are several different ways to form sausages: in links, made by stuffing and tying casings; in cylinders, made by filling slender cloth bags and tying the ends; and in patties formed from bulk sausage meat. These methods are further described in the recipe instructions below.

AMERICAN PORK SAUSAGE

- 2 pounds lean pork
- 1 pound fat pork
- 1 tablespoon sage
- 2 teaspoons salt
- 1 teaspoon freshly ground black pepper
- 1 teaspoon ground cloves
- 1 teaspoon ground mace
- 1/2 whole nutmeg, grated
- 1 teaspoon ground coriander

Grind meat, using the fine blade of the food chopper, and mix thoroughly with other ingredients. Make 2 cylindrical bags of cloth this way: Cut 2 circles of unbleached muslin 3 1/2 inches in diameter. Cut 2 pieces of cloth 10 inches wide and

12 inches long. Stitch the 12-inch sides together, forming tubes, and sew a circle on one end of each tube. Fill these long bags (3 inches in diameter) with sausage meat, tie tops securely with twine, and refrigerate. Makes 3 pounds of sausage. To serve the sausage, slice right through the cloth in 3/4 or 1-inch-thick slices; remove cloth, dust meat with flour or not, as you like, and brown on both sides.

SONORA CHORIZO (Mexican Sausage)

- 2 pounds pork
- 10 ounces pork or beef fat
- 1 large onion
- 6 cloves garlic
- 1 can (4 oz.) pimientos
- 2 ounces (1/4 cup) chile powder (or more)
- 1/2 cup vinegar
- 1/4 cup brandy or tequila
- 1 teaspoon freshly ground black pepper
- 1 teaspoon cinnamon
- 1 1/2 teaspoons cumin
- 2 1/2 teaspoons salt

Grind pork with coarse blade of food chopper. Finely dice fat (do not grind). Chop onion very fine, and add other ingredients. If a hotter chorizo is wanted, add more chile powder. Two ounces makes a mild chorizo, suitable to most American palates. (NOTE: All the ingredients except the meat can be whirled in a blender; in this case, dried red chiles, soaked after their stems and seeds have been removed, may be used in place of the chile powder.)

Mix all ingredients. Prepare pig casings (see next column), fill with mixture, tie every 4 inches, and hang to dry for 24 hours in a breezy spot, away from flies,

or in the house with an electric fan blowing on them. These will keep, refrigerated, for several weeks. Makes 20 sausages 4 inches long.

This sausage is extensively used in such Mexican dishes as tacos and *chilaquiles*. For more ways to use it in your cooking, refer to the article, *Mexico's spicy chorizo*, in the July 1958 *Sunset*. See also page 182 in this issue.

Casings are available in Mexican markets and many other markets patronized by foreign-born shoppers. Or your meat man can order them for you. The salted casings must be soaked in warm water for 3 or 4 hours, then rinsed in running water (put one end over the end of the faucet and let the water run through). It is also a good idea to pour a cup of vinegar through the casing, so the sausage will keep better.

Cut the casing in about 4-foot lengths for easier handling. Tie one end, press out all air through the other end, and fill, using a funnel, pastry gun without a tube, or a sausage-stuffing machine. Tie in the lengths called for by your recipe.

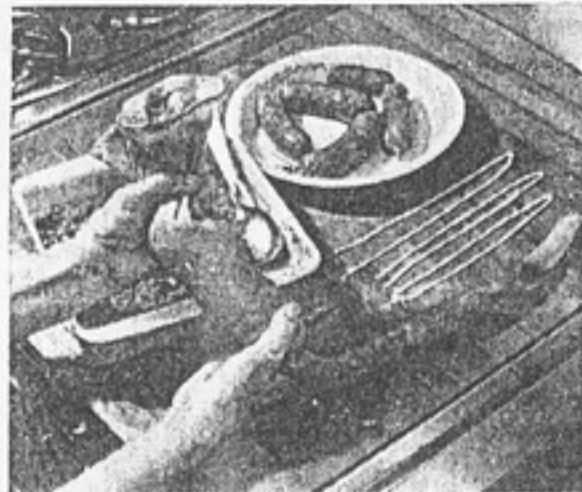
ITALIAN SWEET SAUSAGE

- 1 pound lean pork
- 1/2 pound fat pork
- 1 1/2 teaspoons salt
- 1 teaspoon fennel seed
- 1 small clove garlic
- 1/4 teaspoon freshly ground black pepper
- 1/2 teaspoon chile powder

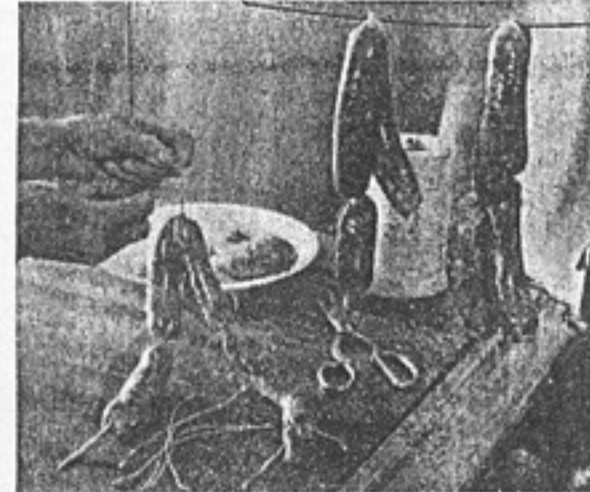
Grind lean pork and fat pork, using the fine blade of the food chopper. Grind



Grinding pork for chorizos (Mexican sausage) is very easy when you use the food chopper attachment of an electric mixer



Stuffing sausage meat into a length of casing is done here with the aid of a pastry bag (minus its decorating tube)



Forming links of sausage, tie filled casing every 1/4 inches with string. Links are looped over clothes hanger to dry 2 1/2 hours

BARBON, AL. WATF

salt, fennel seed, and garlic together in a mortar. Add other ingredients, fill pig casings, and tie in 8-inch lengths. Dry for 2 or 3 hours (see chorizo instructions) before refrigerating. This makes 4 sausages.

These English sausages are mild, flavorful.

OXFORD SAUSAGES

- 1 pound pork
- 1 pound veal
- 1 pound beef suet
- ½ pound fresh bread crumbs (½ loaf)
- Grated peel of 1 lemon
- 1 whole nutmeg, grated
- ½ teaspoon each sage, thyme, savory, and rosemary
- 2 teaspoons salt
- 1 teaspoon freshly ground pepper
- ½ cup water
- 2 eggs

Grind pork, veal, and suet together, using fine blade of food chopper. Combine with other ingredients, and mix well. Stuff casings, or form in patties, and refrigerate. Broil or fry until nicely browned. (Or bake, like a meat loaf, and serve cold.) Makes about 4 pounds.

A pleasing, distinctive flavor of herbs distinguishes this sausage.

ROSEMARY SAUSAGE

- 1 pound pork
- 1 pound beef
- 1 pound veal
- 1 pound suet
- 1 tablespoon salt
- 1 teaspoon freshly ground black pepper
- 2 teaspoons rosemary
- ½ teaspoon each thyme, marjoram, and freshly grated nutmeg

Using the fine blade of the food chopper, grind the pork, beef, veal, suet. Combine with other ingredients and mix well. Pack in casings and tie every 4 inches; or form into patties, and refrigerate. Makes about 2½ dozen sausages.

This Swedish sausage is traditional at holiday time but it is good anytime.

SWEDISH POTATO SAUSAGES

- 1 pound lean ground beef
- ½ pound fresh ground pork
- 7 cups grated potatoes (about 2½ pounds)
- 1 medium sized onion, chopped
- 2 teaspoons salt
- 2 teaspoons pepper
- ½ teaspoon ground ginger

Mix ingredients well, stuff casings, and cut into 24-inch lengths. Cover with salted water (using 1 teaspoon salt to each 2 quarts water), and keep refrigerated.

To cook, simmer in the salted water for a half hour, drain, and coil in a large skillet with ¼ cup of butter. Cook until brown

on one side; turn and brown on the other. (NOTE: If you're giving Swedish potato sausage as a gift, pack in salted water in a half-gallon plastic container, and write out directions for refrigerating and cooking.)

Italian Cheese Sausage. Cut 3½ pounds boneless pork butt or shoulder into cubes, adding additional pork fat if needed to make about ⅓ fat and ⅔ lean (see Buying and Grinding); wrap and chill as long as overnight.

Fit food chopper with a coarse blade and put meat and fat through twice. Crush 2 teaspoons fennel seed and 1 to 1½ teaspoons crushed red pepper with a mortar and pestle. Mix well with the ground meat, adding 1 or 2 cloves garlic (minced or pressed), 1½ to 2 teaspoons salt, ¾ to 1 teaspoon pepper, ¾ cup grated Parmesan cheese, ¼ cup chopped parsley, and about ½ cup dry red wine or water. Taste for fat and seasoning (see Testing). Shape into patties or stuff into casings (directions follow). Makes about 3½ pounds sausage.

Spicy Pork Breakfast Sausage. Cut 3¾ pounds boneless pork butt or shoulder into cubes and dice 1 pound lean bacon. Consider the bacon as the fat when adjusting proportions of fat and lean meats (see Buying and Grinding); wrap and chill as long as overnight. Discard or freeze any excess meat fat.

Put pork and bacon through the coarse blade of a food chopper twice. Mix well with 3½ teaspoons rubbed sage, 1 teaspoon ground nutmeg, ¼ to ½ teaspoon

cayenne, 1 to 1½ teaspoons salt, 1 teaspoon pepper, and about ½ cup water. Taste for fat and seasoning (see Testing). Shape into patties or stuff into casings (directions follow). Makes about 4¾ pounds sausage.

Garlic Sausage. Cut 3½ pounds boneless pork butt or shoulder into cubes, separating fat and lean. Put ½ pound ground beef with lean pork before adjusting fat ratio; add more fat if needed (see Buying and Grinding); wrap, chill up to overnight.

Put pork and fat through the coarse blade of a food chopper twice. Then mix well with the ground beef, 1 large onion (finely chopped), 2 to 3 large cloves garlic (minced or pressed), 1 tablespoon paprika, 1 to 1½ teaspoons each crushed red pepper and chile powder, 1½ to 2 teaspoons salt, ¾ to 1 teaspoon pepper, 3 tablespoons nonfat dry milk, and about ¾ cup water. Taste for fat and seasoning (see Testing).

Shape into patties or stuff into casings (directions follow). Makes about 4 pounds sausage.

Stuffing the casings

For each recipe you'll need 4 to 5 yards of casing. Cut into 2 to 3-foot lengths. Let soak in warm water for 10 minutes, then rinse as shown in step 1 on page 93. Let stand in warm water until you're ready to use them; then drain and strip out excess water. (If you have any casings left over, strip out excess water and place in a plastic or glass container.



BARROW M. WATT

Test a small cooked sample to check the taste, then adjust seasonings and amount of fat before making patties or stuffing casings

Sprinkle with 2 tablespoons salt; cover airtight and refrigerate.

Ease a rinsed length of casing onto the stuffing tube as shown in step 2, leaving the last 1½ inches hanging free. As one person forces meat mixture into the chopper, the other person holds the casing at the mouth of the tube with one hand, gently easing casing off tube with other hand as sausages are stuffed. Fill casings loosely or they will tear.

At first, it's easier to stop the grinding motion when it's time to form each link, twisting casing as shown in step 3. After stuffing a length of casing, retwist at ends and between links.

If casing tears, stop grinding motion and gently squeeze casing, forcing meat along to avoid torn place. Then twist off and

begin a new link. If air bubbles form inside a link, pierce casing with a fine needle. If meat mixture is too thick and casing tears, add more water or wine.

To force the last of the meat into casing, feed through some bread (as described in Buying and Grinding), stopping as soon as you see or feel it coming through.

Wrap sausage links airtight and refrigerate or freeze to store.

Cooking your sausage

To pan-fry sausage patties, fry slowly in butter or margarine over medium heat until nicely browned on both sides.

To broil sausage patties, place on a rack in a broiler pan; broil 4 to 6 inches from heat until browned on both sides.

To pan-fry sausage links, first place

about ¼ inch water in a frying pan and bring to boiling. Add sausages, reduce heat to keep water simmering; cover and simmer gently for 10 to 12 minutes. Drain liquid from pan, then add enough butter or margarine to prevent sausages from sticking and fry slowly, uncovered, over medium to medium-low heat, until nicely browned on all sides.

To broil sausage links, simmer as in preceding recipe and drain. Place links on broiler pan and brush with melted butter or margarine. Broil 4 to 6 inches from heat, turning, until nicely browned.

To pan-fry sausage slices, cut sausages into thick diagonal slices and place in a frying pan. Add enough butter or margarine to prevent sticking. Fry slowly, stirring, until browned on all sides. □

SUNSET JUNE 1976

DON NORMARK



Over 1,500 pounds of spicy chorizos like these are made for Basque picnic in Elko, Nevada

Making Basque sausages

The sausages that Basques call *chorizos* have a touch of garlic, with a distinctive flavor of sweet, dried chile peppers. They're seldom available commercially in the West, so most American Basques make their own—and add them to soups, stews, and bean dishes (see our Basque barbecue menu on page 140). And at the large Basque festivals, chorizos are often sold wrapped in buns like hot dogs.

The sweet dried peppers you'll need for chorizos are available in some Italian and most Mexican markets. They're about 5 to 6 inches long and reddish black in color. They may be labeled mild or sweet dried chiles, or California (Anaheim) dried chile peppers.

In the past, Basques air-dried or smoked

their chorizos to preserve them; and some still do. Our chorizos are to be eaten fresh; they'll keep in the refrigerator up to two days or can be frozen up to three months.

To make your own chorizos, you'll need a meat chopper (hand operated or electric) with a sausage stuffing attachment, or an electric mixer with grinding and sausage stuffing attachments. You'll also need about 6 yards of medium-size natural hog casings about the diameter of a half-dollar; you may have to order them from the meat section of your market (or look in the yellow pages under Sausages or Sausage Casings).

Basque-style Chorizo Sausages

You'll need 4½ pounds boneless pork butt or shoulder and 1 pound boneless beef chuck; if meat looks unusually lean, purchase ½ pound extra pork fat. Cut meat into cubes, separating fat from lean; then add additional pork fat if needed to make a proportion of about ⅓ fat to ⅔ lean (by volume or by weight). Wrap and chill meat while you prepare the pepper purée, or as long as overnight.

Remove stem and seeds from 2 ounces (about 6) sweet dried chile peppers; tear peppers into large pieces. Cover with 1 cup hot tap water and let stand until soft, about 15 minutes. Whirl pepper pieces and ½ cup of the soaking water in a blender until very smooth. Then force the purée through a wire strainer; you should have ½ cup pepper pulp.

Fit food chopper with a coarse blade and put meat and fat through twice. Combine ground mixture with pepper pulp, 1 tablespoon pressed or very finely minced garlic, 3½ teaspoons salt, ¾ teaspoon pepper, 2 teaspoons paprika, and ¼ cup red wine or water; mix well. Cover and chill as long as overnight.

Cut casings into 2 to 3-foot lengths. Let soak in warm water for 10 minutes. Fit one end of each length of casing over faucet and run water through to rinse. Let stand in water; when time to stuff, drain and strip out excess water.

Fit food chopper with stuffing attachment. Ease a length of casing onto stuffing tube, leaving last 1½ inches hanging free. Then, if possible, call in a helper—filling is much easier when two people work together. As one person forces meat mixture through chopper, the other holds the casing at the mouth of the tube with one hand, easing casing off tube with the other hand as sausages are stuffed.

Fill the casing loosely, squeezing and twisting to form 5-inch links.

If mixture is too thick and the casing tears, add 2 or 3 tablespoons wine or water to sausage mixture; mix well. Then squeeze casing to force meat along, avoiding torn place; twist off and begin a new link. If air bubbles form inside casing, pierce with a fine needle.

Wrap sausages airtight; refrigerate or freeze. Makes about 6 pounds sausage.

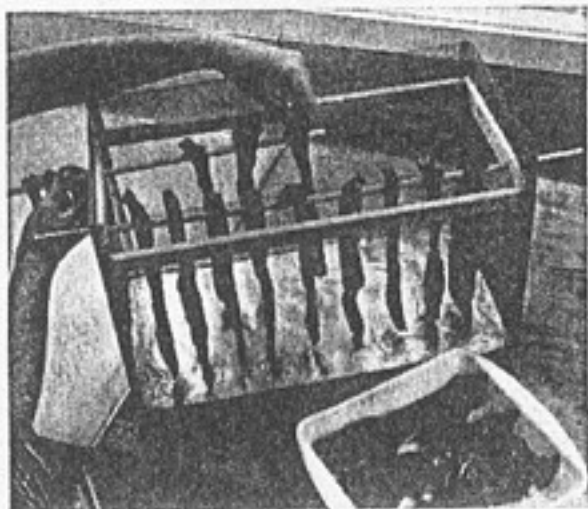
To cook your sausage, first place a scant ¼ inch water in a frying pan; bring to boiling. Add sausages, reduce heat to keep water simmering, and simmer gently for 10 minutes. Then either pan-fry, broil, or grill.

To pan-fry, drain liquid from pan and add enough butter or margarine to prevent sausages from sticking. Cook chorizos slowly over medium-low heat until browned on all sides. To broil or grill, drain simmered sausages and brush with melted butter. Broil or grill 4 to 6 inches from heat, turning until nicely browned all over.

How to make Hawaiian jerky

SUNSET JUNE 1963

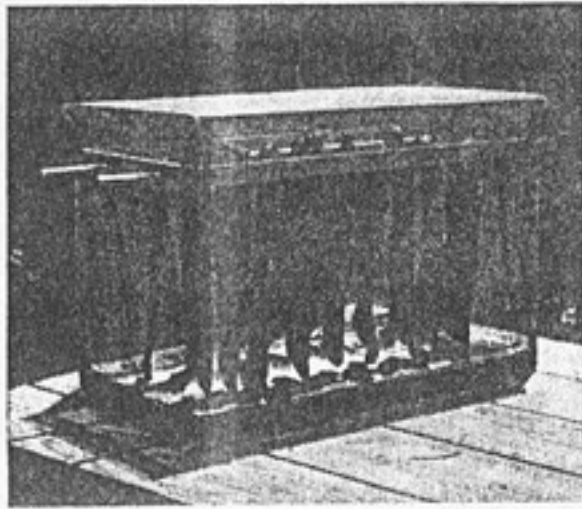
DARROW M. WAIT



String the strips of marinated beef on wood dowels, about an inch apart to allow air to circulate freely between them

When Hawaiian cowboys (*paniolas*) make jerky, their product has flavor overtones of teriyaki. For instead of using a standard brine before drying the meat, they marinate it in a mixture that includes soy, sugar, and ginger.

Like all jerky, or jerked beef or venison, this chewy dried meat lasts indefinitely without refrigeration. For this reason it is an ideal ration for hunting, camping, and pack trips. In order to have some ready to take on your summer outings, you can make it now using beef for the meat. Then later this fall, if you have some venison (and if the days are still warm and sunny enough), make a batch using the venison. Jerky should dry in an insect-free location for three days or longer before you store it. The directions for making a simple, screened jerky drying box (as shown



The long strips of beef hang in the sun in this screen box after they have been marinated in a soy-ginger sauce overnight

in the two photographs) immediately follow the recipe below.

PIPI KAULA (HAWAIIAN JERKY)

- 4 pounds beef or venison cut in strips about 2 inches wide and 1/4 inch thick
- 2 cups soy sauce
- 1/2 cup coarse salt
- 1 tablespoon sugar
- 2 to 3 teaspoons freshly grated ginger
- 2 cloves garlic, minced or mashed
- Pepper, coarsely ground

Trim all fat from the meat. Place strips of meat in a large bowl or glass baking dish. Mix together the soy, salt, sugar, ginger, and garlic; pour over the meat, making sure it reaches all sides of the strips. Refrigerate, covered, for about 24 hours, turning meat two or three times in the marinade.

When you're ready to hang the meat to dry, pepper it to taste. If you use the

drying box, puncture a hole in each strip of meat and string it on the dowel, leaving about 1 inch between strips. Let dry for 3 days or more in full sun. (In a damp climate, bring the box inside at night.) Store dried strips in a cool, dry place up to one year.

MAKING A SCREENED BOX

You can use any screened box large enough for the meat strips to hang freely; the sun and air should reach strips on all sides. Here are directions for the one we used.

For the base, cut a 10 by 18-inch piece of any 1-inch softwood. Tack a 12-inch-wide piece of galvanized fly screen around the base to form all four sides, bringing the ends together and folding them as for butcher's wrap.

Cut 1/2 by 1-inch molding into two 10-inch pieces and two 17-inch pieces; drill two equally spaced holes in each 10-inch piece. Attach molding with a desk stapler to the inside of the screen 10 inches up on each side. With a punch or countersink, push holes through the screen at the holes in the molding, and slip two 3/8-inch thick 24-inch-long hardwood dowels through the holes to serve as hanging racks.

For the lid, cut a piece of screen 14 by 22 inches. Fold under a 1/2-inch strip along all edges; crease. Then shape lid by bending down 1 1/2 inches on all sides, lapping corners and creasing as you would in wrapping a present.

After you have strung the meat on the dowels, cover the box with the lid, bending in the bottom edges slightly for a snug fit.



SUNSET

JUNE 1977

Picnic salami

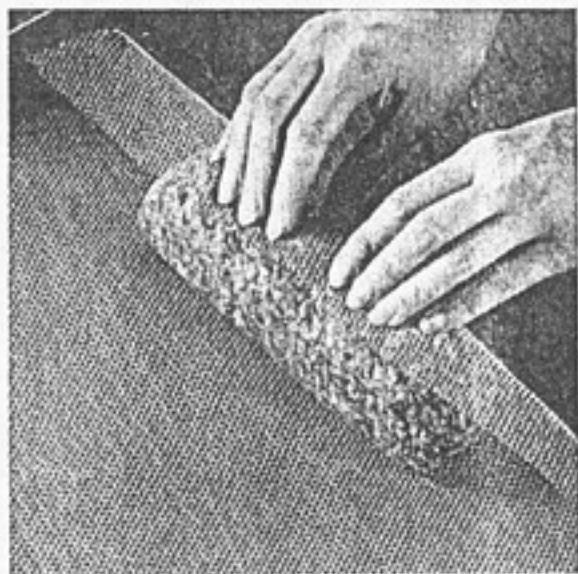
It tastes so very good it's hard to believe it's so easy to make

1. Mix ground beef with curing salt and other seasonings; cover and chill overnight

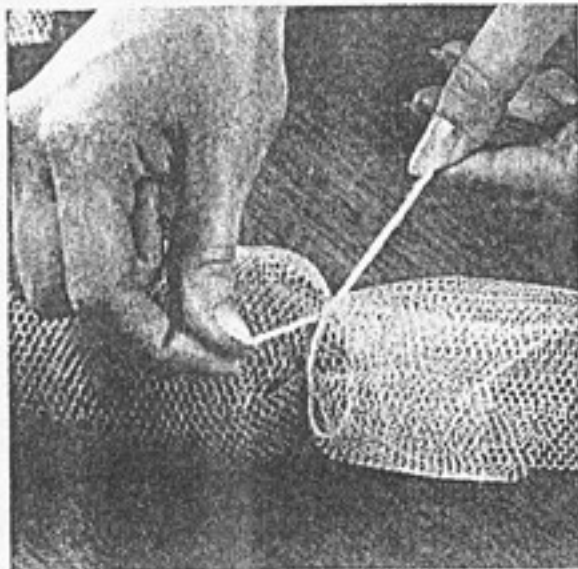
You need 24 hours chilling time, then 4 hours baking time

The taste is great. It's not at all tricky to prepare. And it's inexpensive—a third reason to try this salami.

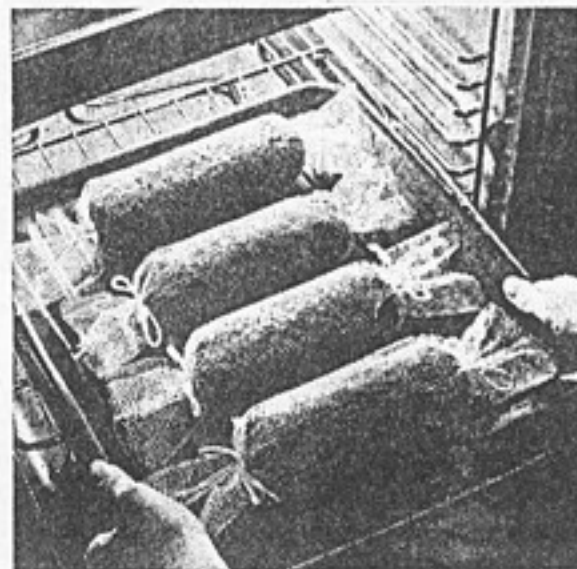
It's not like the dry Italian salami you're familiar with, but more like the cured luncheon meat you can buy. For summer picnics or snacks, our version is tasty alone or with crackers or cheese; it also makes an exceptionally good year-round sandwich meat.



2. Roll each portion in nylon net to make a casing for the salami log



3. Tie ends securely with string, then place rolls slightly apart on a broiler pan rack



4. Bake slowly so salami stays moist while the excess fat cooks out



5. Unwrap after baking; pat rolls well with paper towels. Wrap in foil; refrigerate or freeze

You start with the least expensive ground beef from the supermarket, then mix in various seasonings and chill it overnight. Next day, roll the portions in nylon net (it acts like a casing) and bake them. In the oven the excess fat slowly cooks out, leaving lean, easy-to-slice, fully cooked meat rolls. The salami keeps in the refrigerator up to three weeks or can be frozen up to two months.

The only special ingredient you'll need is prepared curing salt. It's basically a mixture of salt, sugar, spices, and special preservatives that give the salami an appetizing reddish pink color after it's baked. You can buy the curing salt from some butcher's equipment and supply companies and from many feed stores, especially in rural areas.

The nylon net you'll need is sold by the yard in most fabric stores. Purchase the least expensive net with the largest holes.

Smoky Beef Salami

In a large bowl, thoroughly mix 4 pounds ground beef (maximum fat content about 25 percent), $\frac{1}{4}$ cup curing salt, 2 tablespoons liquid smoke, $1\frac{1}{2}$ teaspoons garlic powder, and $1\frac{1}{2}$ teaspoons ground pepper (or 2 teaspoons whole black pepper). Cover and chill for 24 hours.

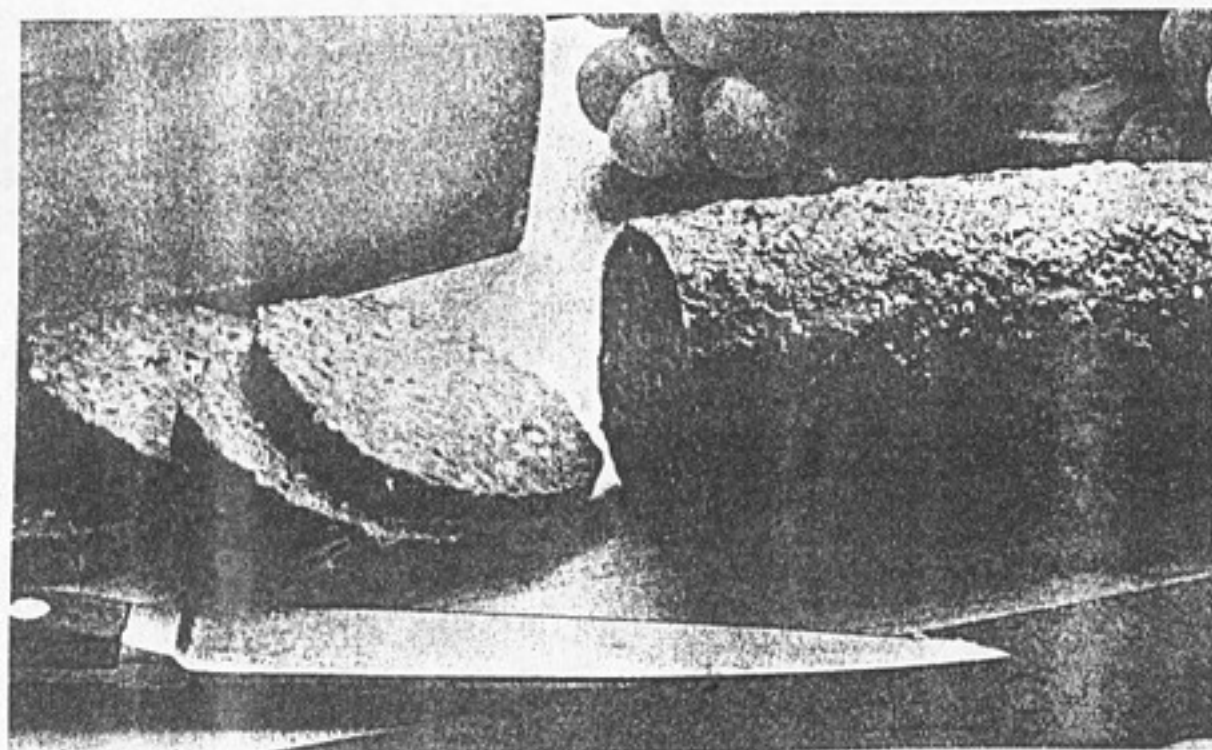
Divide mixture into fourths. Shape each into a compact 8-inch log and place each on a 12 by 18-inch piece of nylon net. Roll up tightly; tie ends with string. Place logs on broiler pan with a rack and bake in a 225° oven for 4 hours.

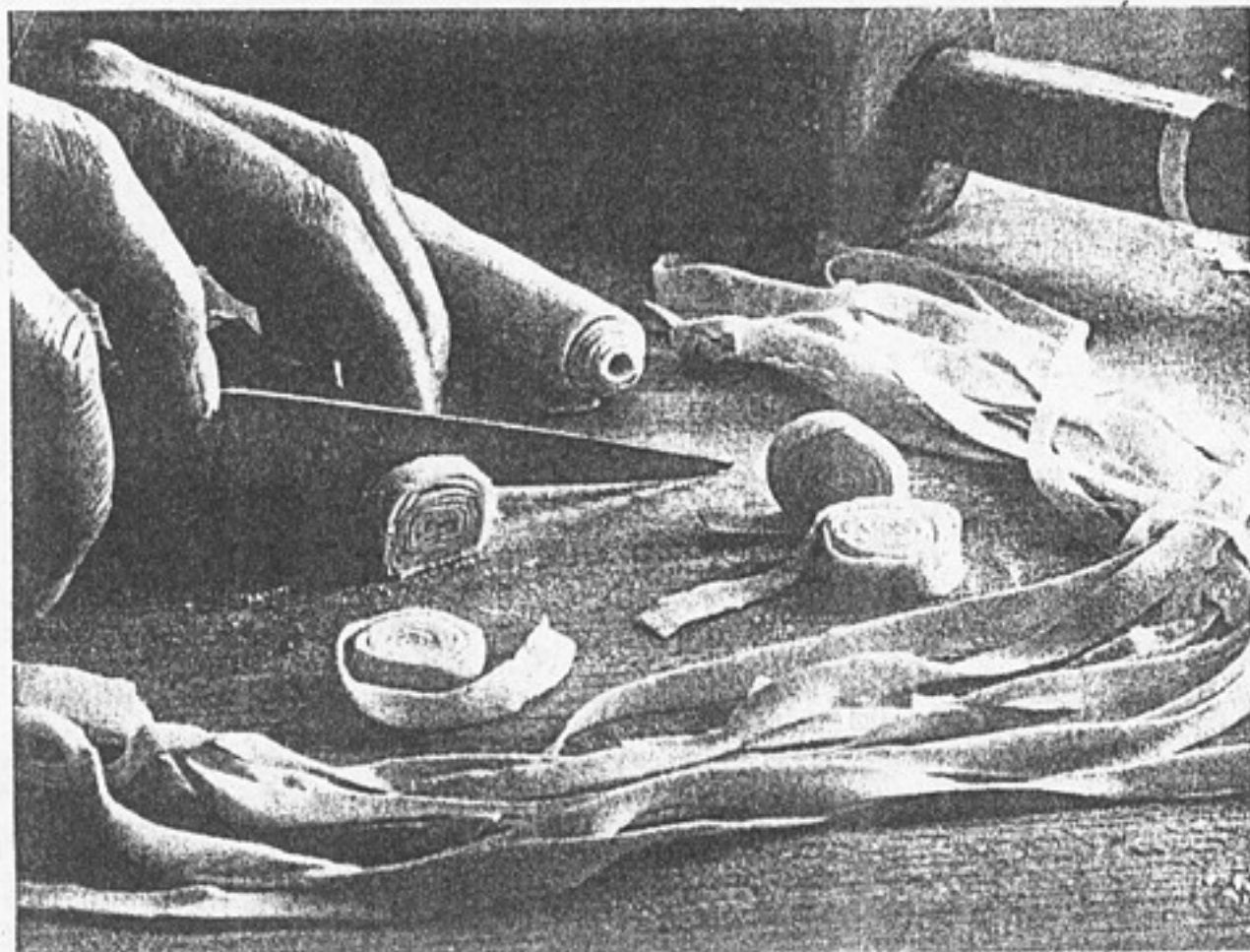
Remove from oven and take off net. Pat rolls well with paper towels to absorb excess fat. Cool slightly, then wrap in foil

and refrigerate or freeze. Makes about 3 pounds.—C. M., Milwaukie, Ore.

Herb beef salami. Prepare as directed above with these changes: Omit liquid smoke and add 3 tablespoons dry red wine. Reduce garlic powder to 1 teaspoon and omit pepper. Instead, add 2 tablespoons mustard seed, 1 tablespoon each dry basil and oregano leaves, 1 teaspoon onion powder, and $\frac{2}{3}$ cup grated Parmesan cheese.

Spicy beef salami. Prepare as above with these changes: Omit liquid smoke and add 3 tablespoons dry white wine. Reduce garlic powder to 1 teaspoon and omit pepper. Instead, add 2 tablespoons chile powder, 2 teaspoons crushed red pepper, and 1 teaspoon ground cumin. □





To cut homemade pasta dough by hand, roll up the dough tightly like a jelly roll, slice it, then grasp the end to unfurl the coil

Making your own noodles

SUNSET JANUARY 1969

It takes time to make egg noodles, but you enjoy the rewards when you dine. Italian-style homemade noodles have a flavor and a velvety texture that lift them well above mere peasant fare.

The basic dough itself is easy to mix; it is the rolling and cutting that can be tedious. However, even these jobs can be made more fun if you approach them in the right spirit. If you cut the paste by hand, unfurl the pasta coils just as you do those colorful paper serpentine on New Year's Eve. And, of course, if you use a pasta machine, you get to operate a fascinating mechanical toy capable of both kneading the dough and cutting it into precise ribbons. Shops that sell Italian and Oriental cookware usually carry pasta machines. They cost \$20 to \$30.

The following recipe explains how to make noodles either by hand or with the aid of a pasta machine. Following it are several ways to prepare the hot cooked noodles for a quick entrée.

HOMEMADE EGG NOODLES

3 egg yolks
1 whole egg
2 tablespoons water
1 teaspoon olive oil

$\frac{1}{2}$ teaspoon salt
About $1\frac{3}{4}$ cups unsifted flour

Beat together just until blended the egg yolks, egg, water, oil, and salt. Spoon $1\frac{1}{2}$ cups of the flour into a large mixing bowl and make a cavity in the center. Pour in the egg mixture and stir with a fork until flour is well moistened. Pat into a ball.

Sprinkle remaining flour on a board and knead dough until it is very smooth and elastic, about 10 minutes. (Knead the dough only 2 or 3 minutes if you will be using a pasta machine later, as its squeezing action is the equivalent of kneading.) Slip into a plastic bag and chill 1 hour. Then shape noodles by hand or use the pasta machine.—S. C., Palo Alto, Calif.

To shape noodles by hand. On a floured board, divide dough into 4 equal portions. Roll out 1 portion at a time into a rectangle about 4 inches wide and as thin as possible, about $\frac{1}{16}$ inch thick. Cut this into two 10 to 12-inch lengths. Transfer to lightly floured sheets of waxed paper and let sit uncovered while you roll rest of dough. (Drying in the air will prevent the dough from sticking together later.)

Starting at a narrow end, roll up each

strip of dough in jelly-roll fashion and cut into $\frac{1}{4}$ -inch-wide strips. Pick up each end of dough and unfurl the coil as you might do a paper serpentine. Lay out on floured sheets of waxed paper and let dry 30 minutes. Makes about 12 ounces.

To shape noodles with a pasta machine. Divide dough into 3 equal portions. Working with 1 portion at a time, feed dough through the smooth rollers of the machine, set as far apart as possible. Fold into thirds and repeat 8 to 10 times (this is actually kneading). If the dough appears moist or sticky, lightly flour it each time. Set the rollers closer together and feed dough through again. Cut length of dough in half if needed so it is easier to handle. Repeat setting the rollers closer together each time until dough goes through the finest setting. Dough will double and triple in length as it becomes thinner, so cut it in half crosswise whenever necessary for easier handling.

Cut the final strip into 10 to 12-inch lengths. Then feed the dough through the wide blades of the cutting section. (It helps to have another person catch the noodles as they emerge from the machine.) Place on floured waxed paper and let dry 30 minutes. Makes about 12 ounces. (The same dough, cut differently, can be the basis for other pastas.)

Homemade egg noodles may be cooked immediately or wrapped in clear plastic film and refrigerated up to two days. Or wrap airtight and freeze up to one month.

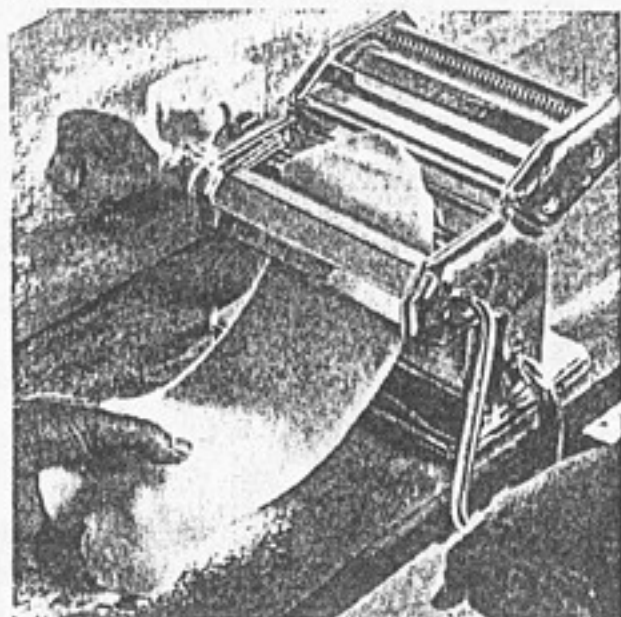
Coated with butter and cheese, *fettuccine* (the Italian term for egg noodles) makes a choice luncheon entrée. You can enrich the dish by folding in butter-sautéed crab, ham, or chicken for a simple yet impressive dinner entrée.

Ideal menu accompaniments include an oil and vinegar-dressed greens salad, French bread, and sweet butter, with winter pears and cheese for dessert.

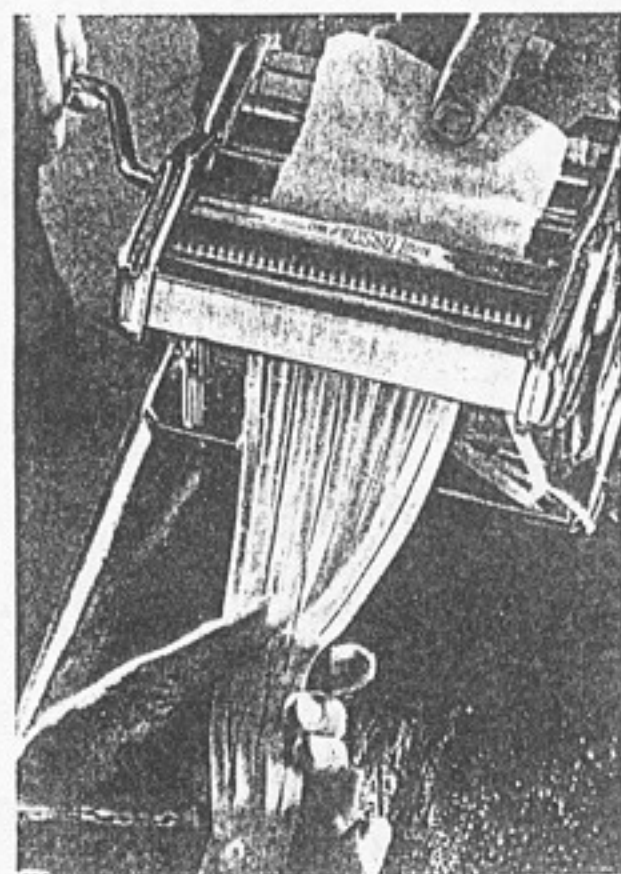
If you lack the time to make your own noodles, you can still create an interesting meal with fresh egg noodles, available in the refrigerated section of a supermarket, or at a local pasta factory. The following recipes adapt to either your own homemade noodles or commercial ones.

FETTUCCINE AL BURRO (Egg Noodles with Butter and Cheese)

6 ounces homemade or commercial egg noodles
Boiling salted water
1 tablespoon salad oil
4 tablespoons butter or margarine
1 cup whipping cream
1 cup freshly grated Parmesan cheese



Hand-cranked pasta machine kneads the dough into springy smooth strips before it stretches dough ultrathin for cutting



Special cutting attachment on machine makes quick work of dough strip; a few cranks and you have a handful of ribbons

Drop noodles into a large pot of boiling salted water with oil and boil uncovered for 5 minutes. Drain through a colander and rinse noodles under a stream of cold water, shaking well.

Melt butter in a large frying pan, add cream, and half the cheese, and bring to a boil. Add noodles and stir quickly with 2 forks to coat noodles completely. At this point you can incorporate the following crab, ham, or chicken variations.

Sprinkle with remaining cheese, heat just until melted, and serve at once. Makes about 4 servings.



Proof of the pasta is in the eating: homemade wheat noodles with carbonara sauce

Chewy health noodles

SUNSET
MAY 1977

Not from the health food store but from your own kitchen. They're nutritious

Some interesting things happen when you make homemade ribbon egg noodles using whole wheat, rye, or buckwheat flour. They have a chewy, yet tender texture and a healthy, whole grain flavor. And after you've tried ribbon noodles, you might use our whole grain doughs, cut differently, for other pastas like ravioli, cannelloni, or lasagna.

If you've made pasta before, you know the dough itself is quick to mix; it's the rolling and cutting that take time, space, and patience. So why not make it a family project or enlist the help of a few

friends and turn it all into a party, followed by dinner featuring the delicious results?

You can shape and cut your noodles by hand or consider investing in a hand-operated pasta machine like the one shown at lower right. It clamps to a table or counter to roll and cut dough. You can find such machines in cookware and department stores for \$30 to \$50.

For a party, serve your noodles with a special sauce such as carbonara (shown at left) or pesto; see page 190 for recipes. Or to go with a meat entrée, simply

serve them tossed with butter and grated cheese (directions at right).

Whole Wheat Egg Noodles

- 2 egg yolks
- 1 whole egg
- 2 tablespoons water
- 1 teaspoon olive oil or salad oil
- $\frac{3}{4}$ teaspoon salt
- $\frac{1}{4}$ cup wheat germ
- $1\frac{1}{4}$ cups stone ground whole wheat flour, unsifted
- Additional whole wheat flour for kneading and rolling

In a small bowl, lightly beat together egg yolks, egg, water, and oil. In a larger bowl, combine salt, wheat germ, and $1\frac{1}{4}$ cups flour; make a well in the center. Pour egg mixture into flour well and mix with a fork. Gather dough into a ball.

Knead on a floured board until very smooth, about 10 minutes (with a pasta machine, knead by hand 3 to 4 minutes, then let the machine do the rest). The dough can be wrapped and chilled up to 4 hours if necessary. Divide into fourths; then roll and cut.

To roll and cut by hand. On a floured board, roll 1 portion of dough (cover remainder) into a rectangle about 5 inches wide, $\frac{1}{16}$ inch thick. If dough is sticky, turn and flour both sides as you roll. Cut crosswise in half and set on waxed paper or cloth towels. To make dough easier to handle and cut, let it dry while you roll the rest of the dough.

Starting at a narrow end, roll up each long rectangle, jelly-roll fashion, and cut into $\frac{1}{4}$ -inch-wide strips. Unfurl strips and lay on waxed paper or cloth towels; let dry until all the dough is cut.

To roll and cut with a pasta machine. Slightly flatten one portion of dough; cover remainder. Feed dough through the smooth rollers, set as far apart as possible. Refold into thirds and feed through again; repeat folding and rolling 5 or 6 more times. If dough is sticky, flour both sides each time you roll.

Set rollers one notch closer together and feed dough through (without folding) 2 or 3 more times. Cut length in half so dough is easier to handle. Repeat rolling, setting rollers closer each time. Feed dough through each setting 1 or 2 times until it's $\frac{1}{16}$ inch thick (on most machines, this is the third from last notch). Change to the $\frac{1}{4}$ -inch blade setting; feed dough through. Lay noodles slightly apart on waxed paper or cloth towels. Let dry until all are rolled and cut.

Cook pasta or wrap well; refrigerate up to 2 days or freeze to 1 month. Makes about 12 ounces (4 servings).

Rye noodles. Prepare Whole Wheat Egg Noodles with these changes: Omit wheat germ. Reduce whole wheat flour to $\frac{3}{4}$ cup and add $\frac{3}{4}$ cup unsifted rye flour. Use additional whole wheat flour for kneading and rolling.

Buckwheat noodles. Prepare Whole Wheat Egg Noodles with these changes: Omit wheat germ. Reduce whole wheat flour to $\frac{3}{4}$ cup and add $\frac{3}{4}$ cup buckwheat flour. Use additional whole wheat flour for kneading and rolling.

Spinach noodles. Thaw $\frac{1}{2}$ package (10-oz. size) frozen chopped spinach. Squeeze out as much moisture you can,

then chop as finely as possible. Prepare whole wheat, rye, or buckwheat noodles, stirring spinach into egg mixture and increasing the amount of whole wheat flour by $\frac{1}{2}$ cup.

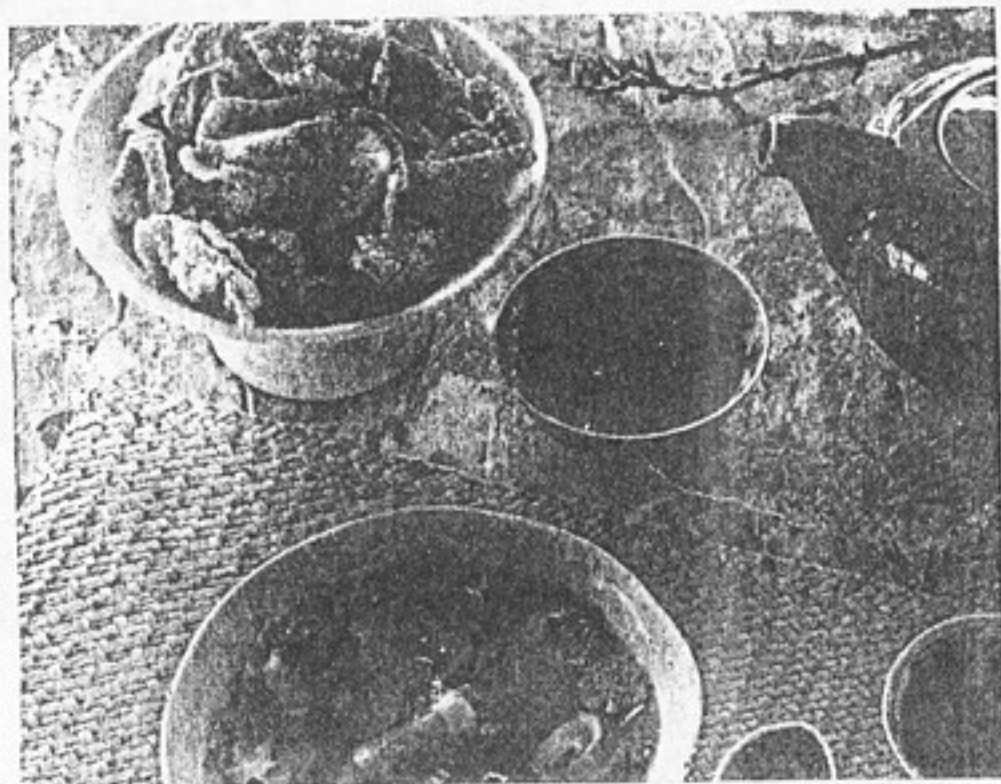
Pasta with Butter and Cheese

Cook 6 to 12 ounces homemade noodles in 4 to 6 quarts of boiling salted water (with 1 tablespoon salad oil) until *al dente* (tender to bite), 5 to 7 minutes. Drain; turn into a serving dish. Toss with 2 to 4 tablespoons butter or margarine and $\frac{1}{2}$ to 1 cup grated Parmesan cheese. Makes 6 to 8 side-dish servings. □

DARROW M. WATT



Pasta machine can save time and muscle—it rolls the dough to the proper thinness, then cuts it into ribbons for you. But it's not essential for making homemade pasta, you can also roll and cut the dough by hand



Won Ton, deep fat fried and dunked in a sweet-sour sauce, is a crisp appetizer; served in clear soup stock, it's a whole meal

SUNSET JUNE 1953

Raviolis... the Chinese way

The Chinese often eat Won Ton—Chinese raviolis—like we eat snacks. They also put them in clear broth with meat and hard cooked eggs for a one-dish meal.

Many Chinese noodle factories and restaurants sell the 3-inch ravioli pastry squares, or you can make your own from the recipe on page 25 of the *Sunset* book, *Cooking with a Foreign Accent*.

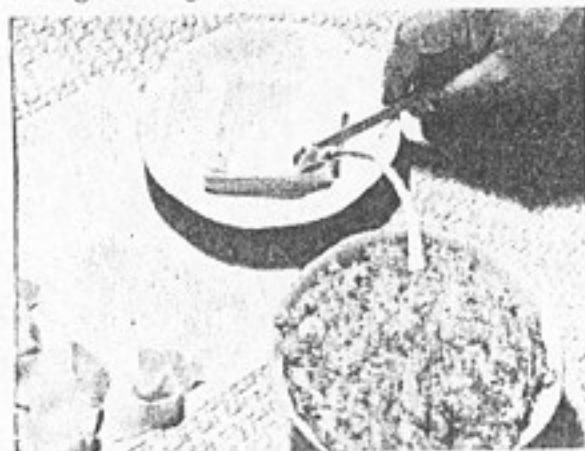
Here is a recipe for the filling:

Soak 1 dried mushroom cap in water until soft; drain; chop finely. Then chop very finely the following: $\frac{1}{4}$ pound lean pork, $\frac{1}{4}$ pound raw prawns, 3 water chestnuts, and 1 small green onion and top; mix with mushroom. Season with $\frac{1}{2}$ teaspoon soy sauce, $\frac{1}{8}$ teaspoon monosodium glutamate, and $\frac{1}{4}$ teaspoon salt. This makes enough filling for 100 Won Ton. For di-

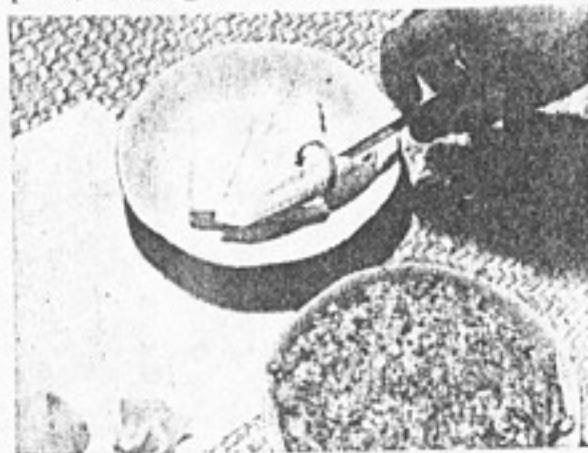
rections on how to fill and shape Won Ton, see photos here and on page 146.

Fried Won Ton. Drop a few at a time into hot deep fat (350°) and cook 2 minutes on each side; drain. Serve hot or cold with a thin sweet-sour sauce.

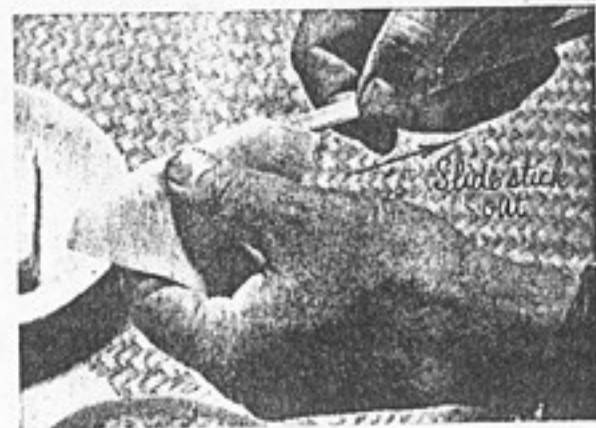
Won Ton Soup. Drop filled squares into a large kettle of boiling water. To prevent Won Ton from sticking together, cook only a small number at a time. After they rise to top of water, cook for an additional 4 minutes. Turn into colander, pour warm water over them to remove excess starch; drain. For each serving, season a bowlful of hot chicken broth with 2 drops sesame seed oil and $\frac{1}{4}$ teaspoon soy sauce; then drop in 6 cooked Won Ton along with a slice of hard cooked egg, 3 slivers cooked pork, sliced green onion. Serve at once.



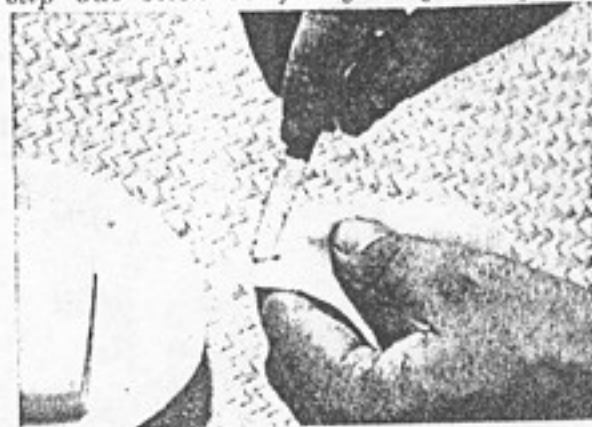
1 Catch $\frac{1}{4}$ teaspoon of filling on tip of chopstick or thin bamboo or wooden stick. Use less filling for fried Won Ton. Place on corner of noodle dough square



2 Press the filling onto dough and turn stick slightly so filling and pastry hold together. Loosely roll ravioli on stick to within $\frac{1}{2}$ inch of center of square



3 With stick still inside ravioli, lift Won Ton from dish, holding rolled part of dough with thumb and forefinger. Gently slip out stick so filling stays in place



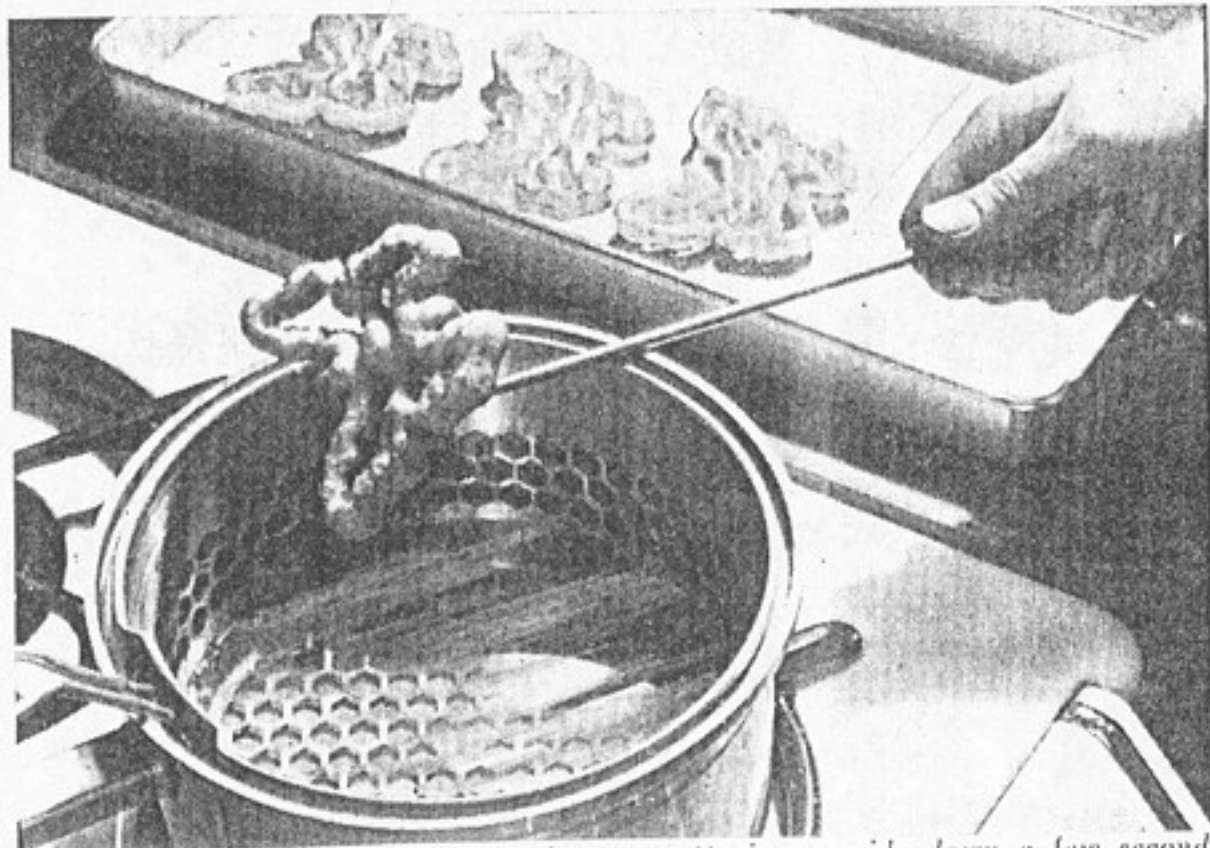
4 Still holding rolled part of ravioli, moisten the top side of left corner with tip of stick which has first been dipped into filling. Do not use water to moisten



5 Continue holding the Won Ton in same position, then twist right corner over and around thumb so dough covers moistened corner. Free corner should curl



6 To seal, press the two corners together firmly. Do not fill raviolis more than one hour before cooking. Cover with a damp dry cloth and store in refrigerator



After batter is cooked, turn butterfly or rosette iron upside down a few seconds to drain off excess fat. With fork, push butterfly onto paper toweling to cool.

The essential steps in deep fat frying

SUNSET FEBRUARY 1953

Many cooks experiment with deep fat frying, but an occasional French fry or fritter is usually the sum total of their frying experience.

Actually, deep fat frying is easier than it might appear. The requisites are few: plenty of fat at a proper temperature, correctly prepared food, no overloading of the kettle.

Shortening, salad oil, and lard are all good choices for the frying kettle because each has a high smoking point. When fat starts to smoke, there are various reactions that spoil the flavor and actually break down the fat. Butter, margarine, meat drippings, and olive oil should not be used because they do smoke at the high temperatures necessary for deep frying.

The same fat may be used several times if you give it the right company—doughnuts flavored with fillet of sole won't win any accolades. Remove the crumbs dropped from coatings by pouring the fat through a fine mesh sieve or by straining it through cheesecloth. If crumbs are left in, they eventually become charcoal and give the fat an objectionable flavor. Raw potato slices, added to the fat when you start to heat it, will clarify the fat by attracting fine particles which escaped the sieve or cheesecloth.

In a temperature-controlled electric fryer, the fat always stays at the correct temperature. If you use a deep kettle as your

utensil, a special deep fat thermometer will protect you from frying failures. Lacking either of these, you can follow the somewhat unreliable bread cube test. Drop a cube of two or three-day-old bread into the kettle and check how long it takes for the cube to brown. If a cube browns in 20 seconds, the fat is ready for French fries (385° to 395°). If the time is 60 seconds, you can drop in doughnuts, fritters, and other uncooked foods (350° to 375°).

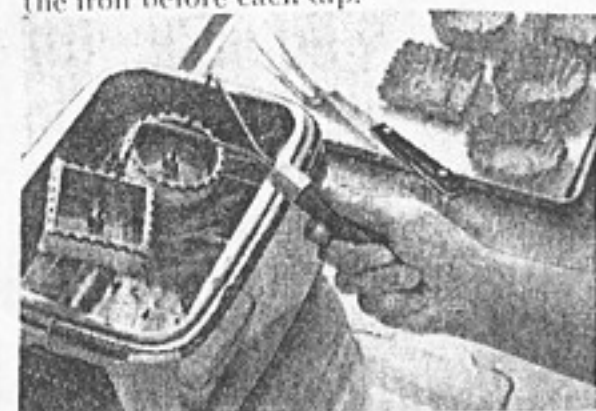
When the fat is hot enough, waste no time dropping in the food to be fried; but don't be too anxious to get everything fried at once. If you put in too much cold food at one time, the temperature goes down 25° to 50°. Potatoes won't brown; fritters will soak up fat.

One general caution: prepare foods in small units for deep frying. Cut the potatoes in small, slim pieces. Make the croquettes small so they won't burst from an accumulation of steam in the center before they brown. Drop in the fritters with a teaspoon rather than a mixing spoon if you want the centers to be done by the time the outside is gently browned. Specialty irons add to the fun of deep frying. Such irons used to be in every pantry, but today their use has become almost a lost art.

Timbale irons dipped in batter and then into the hot fat turn out attractive easy

for creamed foods or vegetables. Butterfly or rosette irons dipped in a slightly sweetened batter make delicately crisp and lacy "cookies." Dust with powdered sugar.

The important tricks in using these irons are: (1) have the iron very hot before you dip it in the batter; (2) dip so the batter comes just short of the top of the iron; (3) fry quickly, drain well; and (4) reheat the iron before each dip.



Timbale irons come in many shapes, deep and shallow. Don't let batter go over the top, or fried case cannot be removed. Beat egg slightly, then stir in milk until blended. Sift the flour and the salt into the egg mixture, mix well; then stir in melted butter or margarine. Strain if there are any lumps. Pour into a cup, bowl, or flat dish that is deep enough so the timbale iron can be put inside without touching bottom. Let batter stand until all bubbles have disappeared.

TIMBALE BATTER

- 1 egg
- ½ cup milk
- ¾ cup flour
- ½ teaspoon salt
- 1 teaspoon melted butter or margarine

Meanwhile, your timbale iron should be heating right along with the fat to a temperature of 375°. Take the iron out of the fat, rest it a second on absorbent paper to remove excess fat, then dip into batter, being careful not to let the batter reach the top of the iron. Immerse in hot fat immediately, cook to a delicate brown (about ½ minute), lift out of fat, drain a second, then cool on paper toweling. Reheat iron before making another. Makes 12 to 16 timbales.

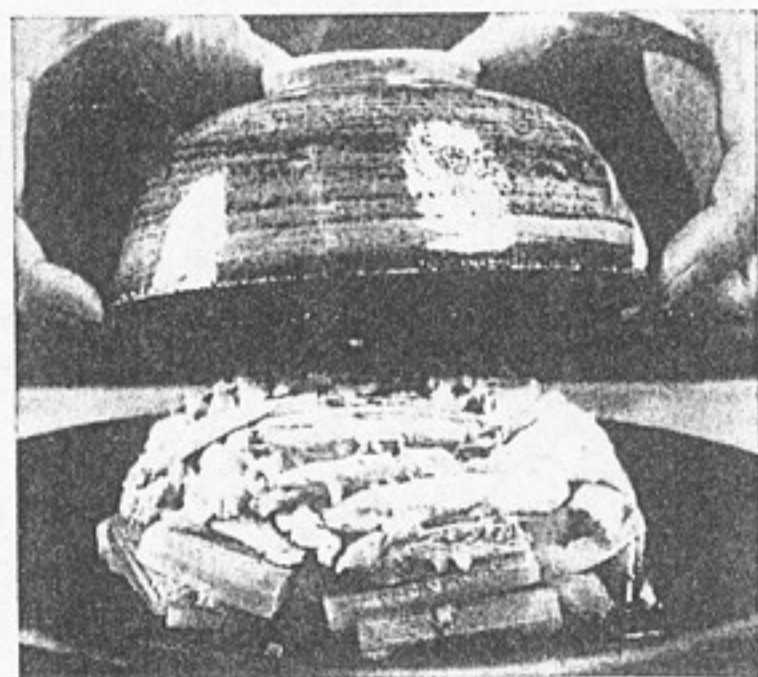
ROSETTE OR BUTTERFLY BATTER

- 1 cup flour
- 2 eggs
- 2 teaspoons sugar
- 1 cup milk
- ¼ teaspoon salt
- 1 teaspoon almond flavoring

Sift flour and measure. Beat eggs until very light; add sugar, milk, salt, and flavoring, and mix well. Add flour and beat all together thoroughly. Follow procedure for Timbales: heat iron and fat to 375°; dip iron into batter, fry, and drain. If rosette or butterfly falls off the iron, fish it out of the fat with a slotted spatula or fork. This makes about 32 "cookies."



1. Assembly for ginger chicken is simple—just lay celery strips atop cooked chicken in bowl



3. To unmold, turn steamed food out onto serving plate



2. Set bowl on rack in bamboo steamer to cook. Here, Szechwan restaurateur Sam Kuo checks chicken and celery as they steam

SUNSET
OCTOBER, 1975



4. Final step—pour on pungent ginger-flavored sauce and the meal is ready to serve

Steam cooking as the Chinese do it in Szechwan. It's easy. It's delicious. You can work a day ahead. Here are three dishes as openers—chicken and pork

If you could look into the kitchen of a Chinese restaurant during preparations for a large banquet, you would probably see the cooks stacking their woks with bamboo steamer baskets.

Steam-cooked dishes can be assembled a day ahead, they require little attention while cooking, and there's little to clean up afterward. At home you can use the stackable bamboo trays (about \$4 to \$8 per section at Oriental hardware or im-

ported cookware stores) over a wok and adapter ring. Or devise your own steamer, putting an elevated rack in a deep kettle, electric frying pan, or chicken fryer with a domed lid.

Steam cooking works well for these three recipes from the Szechwan province of Northwest China, often associated with hot, spicy foods. While typically hot flavors emerge in the ginger chicken (reduce the heat to taste), the chicken and

tofu custard is delicate and creamy, and the garlic-seasoned pork and yams have a mild heat level. Serve one dish to the family or all three to guests as a Chinese-style meal.

You'll find the sesame oil, sweet Chinese soybean paste (or Japanese sweet miso), and Szechwan hot bean sauce at an Oriental market. Or you can use the substitute ingredients in each recipe.

Szechwan Ginger Chicken

Place about 1½ pounds chicken breasts, legs, and thighs in a pan with enough water to cover; simmer, covered, 20 minutes or until fork-tender. Remove from pan and set aside to cool. To the pan add 3 stalks celery cut in ¼ by 2-inch strips; cover and simmer 5 minutes, then remove with slotted spoon; save broth.

Cut chicken from bones, discarding skin; cut into ½ by 2-inch strips. Place strips in a 4 to 5-cup bowl; distribute celery on top. Blend together 1 tablespoon each finely minced fresh ginger, finely minced green onions, and dry Sherry; ¼ teaspoon salt; and ½ cup of the reserved cooking broth. Pour over chicken; cover and refrigerate if made ahead.

To cook, place bowl on a steamer rack set over boiling water; steam-cook 7 minutes. Remove from steamer. Holding chicken and celery in place with a spatula, drain off broth and reserve; invert chicken onto serving plate and keep in a warm oven.

Ginger sauce. Heat 1½ tablespoons salad oil and 1 teaspoon sesame oil (or additional salad oil) in a small pan over medium heat. Add 1 tablespoon each finely minced garlic and minced fresh ginger; sauté 1 minute or until golden brown. Add 2 tablespoons each soy sauce and sliced green onions; 1 tablespoon each vinegar, sugar, and dry Sherry; 1½ teaspoons hot Szechwan bean sauce (or ½ teaspoon liquid hot pepper seasoning); and the reserved broth. Blend 2 teaspoons each cornstarch and water; stir into sauce. Cook, stirring, until sauce boils and thickens.

Pour the sauce over chicken and celery. Makes about 4 servings.

Chicken and Tofu Custard

Cut the meat from 1 large chicken breast (¾ to 1 lb.), discarding bones. Using coarsest blade of food chopper, grind chicken with 4 ounces uncooked bacon; you should have 1½ cups ground meat.

In a blender container, combine ¾ cup water, ground meat, 8 ounces Japanese-style tofu, 1½ teaspoons cornstarch, 2 egg whites, ¾ teaspoon salt, and ¼ teaspoon each ground white pepper and sesame oil (optional). Whirl at low speed, stopping and stirring as necessary, until mixture is smooth; cover and refrigerate if made ahead.

Generously grease a 9-inch pie pan. Spoon chicken mixture into pan, spreading evenly. Place on a steamer rack set over boiling water; steam-cook 10 minutes or until center is firm to touch.

Three stacked bamboo steamer racks in wok with adapter ring hold three-course meal—beef and yam in bottom, chicken and tofu in middle, ginger chicken in top. They're stacked according to the cooking time required for each recipe



Remove from steamer; tip pan to drain excess drippings. Invert onto a serving plate and pour over green onion sauce (recipe follows). Serve in wedges. Makes about 4 servings.

Green onion sauce. In a pan, blend ½ cup regular-strength chicken broth, 1 tablespoon each thinly sliced green onions and dry Sherry, and a dash of sesame oil (optional). Blend 1 teaspoon each cornstarch and water and stir into broth. Cook, stirring, over medium-high heat until sauce boils and thickens.

Spicy Pork and Yams

Cut 1 to 1¼ pounds boneless pork butt into ½-inch cubes; trim fat. In a bowl, blend 2 tablespoons cream of rice cereal; 1½ tablespoons each soy sauce, dry Sherry, and salad oil; 1 tablespoon sweet Chinese soybean paste or Japanese sweet miso (or 1½ teaspoons firmly packed brown sugar); 1 teaspoon each finely minced fresh ginger and minced garlic; 1 teaspoon Szechwan hot bean sauce (or

use ¼ teaspoon liquid hot pepper seasoning); and a dash each of sesame oil (optional), white pepper, and salt. Add pork cubes, mixing to coat evenly; cover and marinate in the refrigerator 8 hours or overnight.

Peel 2 medium-sized fresh yams (about 1 lb.); cut into ½-inch slices. Blend 1 tablespoon each dry Sherry and cream of rice cereal, ¼ teaspoon salt, and a dash of white pepper; mix with yams to coat. Arrange pork cubes in a 4 to 5-cup bowl; distribute yam mixture on top.

To cook, place on a steamer rack set over boiling water; steam-cook 40 minutes or until meat and yams are fork-tender.

Meanwhile, cook 1 package (10 oz.) frozen spinach leaves according to package directions; stir in 2 teaspoons sesame oil (optional) and salt and pepper to taste. Invert pork and yams onto a serving plate, top with 2 tablespoons sliced green onions, and surround with spinach. Makes about 4 servings. □

Makeshift steamer is really a deep pan with cake rack elevated on empty tuna cans; chicken and tofu custard cooks on rack. To serve, invert custard onto plate and garnish with green onion sauce, mushroom slices, and parsley





Chinese cook works with both hands, his stove equipped with extra-high heat for fast cooking. Shallow layer of running water around wok in counter cools work area

SUNSET
FEBRUARY 1971

Cooking with a 鍋 (wok)

The great Chinese cooking pan with its curved sides and curved bottom can perform wonders in your kitchen

If after ordering dinner in a Chinese restaurant you could follow the waiter back to the kitchen, you would see something like the scene at left.

There a chef would be working with both hands, setting off bursts of steam and loud sizzling sounds as meat and vegetables go into his pan. After a few minutes of cooking, the dish would be finished, and you would have seen how a Chinese cook uses a wok.

If you looked around that Chinese kitchen, you might not see any other cooking pans—just a row of woks, each presided over by a cook. The centuries-old design of this pan works so remarkably well for many kinds of cooking that nearly every dish on the Chinese menu can be cooked in it.

The wok's size and its half-dome shape account for its versatility. A little sauce can cook efficiently in the bottom; the wok also accommodates a big boney soup or stew. You can deep-fry foods in less than the usual amount of oil, and if you set a rack inside over an inch or so of boiling water, you can steam-heat a plate of dinner quickly or cook a fish.

If you have used a wok only for stir-frying Chinese food, you may be sur-

prised to discover how well it works for scrambling eggs, sautéing mushrooms, or browning meat for a stew.

The wok, in use, is hottest at the bottom and the heat lessens up the pan sides. When browning meat for a stew, for example, you move the pieces that brown first up the wok sides, allowing others to roll to the bottom. To scramble eggs in a wok, you draw the cooked egg up the sides and let uncooked portions flow into the bottom. This wok-cooking principle is especially advantageous when sautéing a whole fish such as trout or sole; start it cooking with the thickest part in the bottom in melted butter (about 1/3 inch deep); then slide fish along, cooking thinner tail portions less.

More specific directions for using a wok follow on this and the next three pages. If you don't already own a wok, turn to page 153 for suggestions to help you choose from the wide selection available.

(Someone may tell you about, or a shop clerk may try to sell you, something called a flat-bottomed wok. Although it resembles a wok except for the bottom, it is either a tempura pan or a Spanish paella pan. These function like frying pans and not at all like a wok, so are not

considered here.)

How to use a wok on your range

No ordinary range can exactly duplicate the fast, intense heat that the cook in a Chinese restaurant uses. Neither could you handle with ease a pan quite as large and heavy as his. Nevertheless, we believe it's possible to achieve fine results when you cook with a wok at home.

Assuming that your range was almost certainly not designed for a wok, the problem is to find the most effective arrangement for transferring heat from the element or burner to the pan's round bottom. The solution varies a little with each range but we have cooked successfully in woks on dozens of different

modern electric and gas ranges.

High heat is essential for some, but not all, wok cookery. However, to achieve high enough heat to stir-fry Chinese dishes is the greatest challenge for home cooks. Here are some suggestions.

Before you start to cook, experiment with an empty wok. If you have a gas range, place it over the burner and rest it directly on the utensil supports; if it rests fairly steadily there and the pan is 1 inch or less from the top of the burner, this arrangement should work well for much of your cooking. However, for frying in deep fat or simmering a wokful of soup, you may need a more stable arrangement for complete safety. An adapter ring base or stand is made especially for this purpose. The rings have slanted sides, so the circle is larger when turned one way up than the other way up. Try removing the utensil support of your gas range, placing the ring directly on the cook top, and turning it first one way and then the other to position the pan no more than 1 inch above the burner. If the burner is too high (as was the case with the range shown on page 75), you might be able to buy a higher ring or you will need to elevate it some way, such as putting the utensil support back in place and setting the ring and wok on top.

If you cook on an electric range, the ring

stand will steady the wok over the element. We use it for most electric cooking except stir-frying. To cook at high temperatures, the bottom of the wok should make contact with the range element. When there is space between pan and element, much heat is lost, and prolonged use may even shorten the life of the element.

The solution for electric range users is to buy a ring stand (or make one) that cradles the wok so that the pan bottom rests on the element. To make a ring stand for your wok, ask in any metal-working shop for a 2 by 36-inch piece of sheet metal, about 20 gauge. At home form this into a ring; connect the two ends together with a small bolt and wing nut, making one of the holes for the bolt a long slot, so you can adjust the ring to fit the wok on your range.

When lower heat is required, it may often be achieved best by suspending the wok in the ring so that it is slightly above the electric element.

The stir-fry technique

The one cooking method that is uniquely Oriental and basic to many of our favorite Chinese meat and vegetable dishes is called stir-frying. Some prefer the term "loss-cooking," but no English words accurately describe it.

A Chinese cook may speak of "wok-air," which is a clumsy translation of what happens when fresh vegetables and meats are cooked in a very hot wok—crisp, yet tender, and with flavor and juices sealed in. To achieve it, we must learn to work with higher heat than is usually used for other cooking.

Our directions for stir-frying in the wok assume the limitations of a home range—and they are realistic about how one needs to proceed when trying a new recipe or using an unfamiliar cooking utensil. Basically, we take a one-hand-to-cook and one-hand-to-hold-the-wok approach. This allows you to move the wok on and off the heat, if needed, to control the temperature.

You'll need a wide spatula—the best are special metal turners curved to fit the wok. If yours is a two-handle wok, use a good barbecue mitt on the hand that grips the wok; you won't need the mitt with a wok that has one wood handle.

You always begin by cutting each vegetable and meat in the recipe to a uniform shape, usually thin slices or shreds, of a size that will cook tender-crisp in 1 to 2 minutes. Vegetables that require more cooking may be parboiled ahead of time,

Usually the meat is mixed with cornstarch and seasonings and there is a little sauce of more starch and seasoning. Assemble all the ingredients and the serving plate within easy reach. You might also set the ring stand nearby in case you need a place to set the hot wok.

The wok should be clean and dry. Place it directly on the element or burner with heat turned to high. Heat the wok before adding oil; then always use a bland salad oil because it can withstand high temperatures without burning. Start cooking, holding the wok with one hand and stirring and tossing with the other. When each meat and vegetable is cooked just right, turn it back into its dish.

We illustrate stir-frying with a Chinese recipe for sliced beef with peppers, the dish you see in preparation at left. You can adapt the method to most Chinese stir-fried recipes. After you have made any dish enough times to have a "feel" for when each part is done, you'll take short-cuts as the chef does, often cooking more than one ingredient at a time.

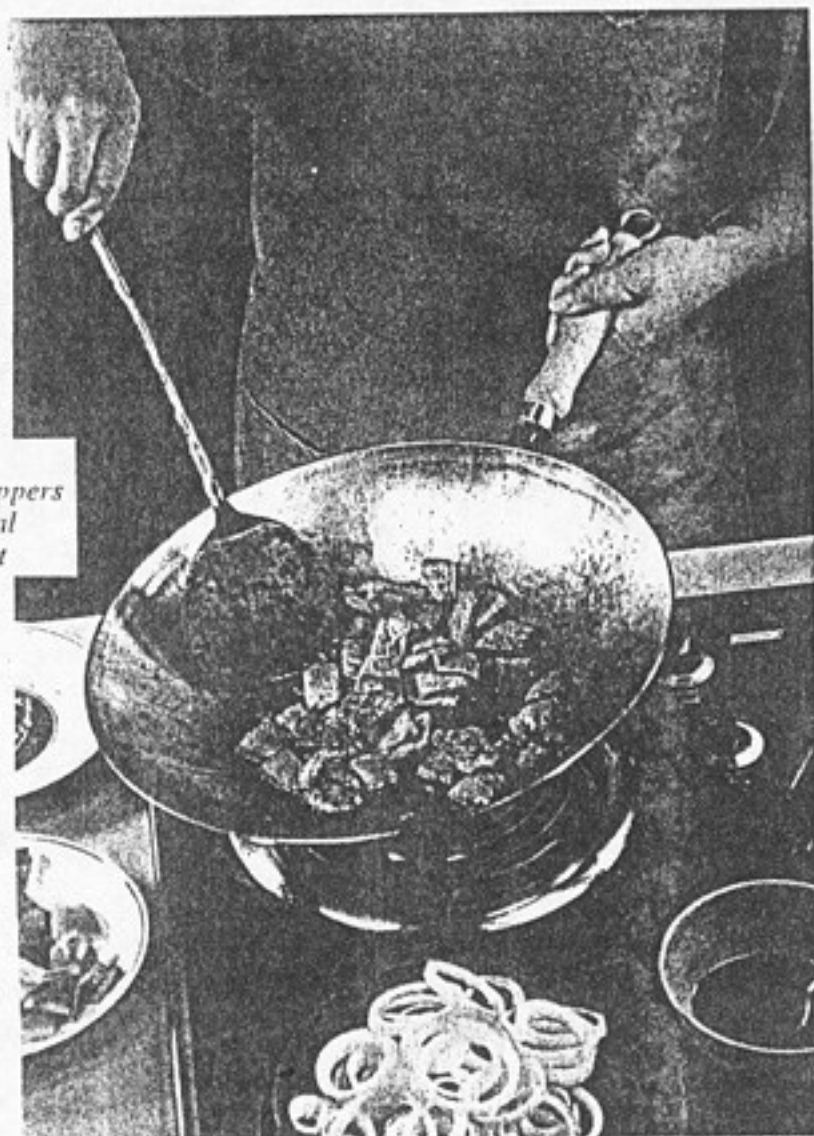
Sliced beef with peppers. You'll need about ½ pound tender, lean beef (such

as flank or sirloin); slice it across the grain in uniform thin slices, about 1 inch square. Combine meat with 1 teaspoon cornstarch and 1 tablespoon soy sauce. Remove seeds and stem from 1 green pepper; cut pepper in 1-inch squares. Slice 1 medium-sized onion; then separate into rings. In a cup combine 1 teaspoon cornstarch with 1 tablespoon each soy sauce, water, and Sherry or mirin (or omit Sherry and use 2 tablespoons water). Place each vegetable and meat within reach of range. Get out the salad oil and serving plate.

Place wok on range, and turn heat on high. When wok is hot, put in 2 tablespoons salad oil. When oil is hot enough to ripple when pan is tipped, add meat mixture; quickly stir and toss with spatula until browned all over, about 2 minutes; turn back into its dish. Reheat wok; add 1 tablespoon oil and peppers; cook, tossing, about 2 minutes; turn back on dish. Add 1 tablespoon oil and onions to wok; toss and cook about 2 minutes.

Push onions to sides of wok, making a well in center, and stir in sauce mixture. Cook about 1 minute, then return pep-

Quickly stir and fry sliced beef, holding wok on high heat; fry peppers and onions the same way. Oriental curved turner helps you work fast



pers and meat to pan. Cook, stirring until it is all reheated, then turn out of pan. Makes 2 servings as main dish.

To clean the wok when you finish cooking, put on highest heat; when it starts to smoke, pour in a little water and swish with a brush (one designed for this purpose shown on page 153). Rinse and dry.

Low-temperature wok cooking

A little experimenting with the wok should be all that's needed to find the handiest arrangement for low, even heat. On an electric range, support the wok in a ring either resting directly on the element or slightly above it, with the temperature adjusted accordingly. On gas ranges you may want to use the ring stand, especially if the wok is rather full, to keep the pan from tipping.

At low temperatures you can cook with butter, margarine, or any cooking oil. Once you have mastered the technique of browning in a round-bottomed pan, you may prefer it to a frying pan for sautéing meat or vegetables, and for braising meat or chicken dishes.

Try the wok for frying bacon arranged as shown in the picture below so the fat drains to the bottom. The bacon will brown first nearest the bottom; turn pieces end to end for even cooking.

To deep-fry in a wok

Many recipes in a Chinese cook book call for deep-fat frying as one of the cooking steps. The Chinese deep-fry shrimp, for example, then make sweet and sour sauce all in the wok. Or they may fry some nuts, such as cashews, set them aside while stir-frying chicken and vegetables, and then add the toasty nuts to make cashew chicken.

The wok makes these procedures practical, and the smaller the amount of food to be fried, the greater its efficiency. A cup of nuts can be deep-fried in only $\frac{3}{4}$ cup of oil. One quart of oil is about 1½ inches deep in a 14-inch wok; with two chicken halves the oil level is raised to about 2¼ inches.

If your family enjoys crusty fried chicken or fish, consider cooking it in your wok. First you'll need an inexpensive wire skimmer (one kind is pictured on page 153), usually found where woks are sold. Use it to remove all particles of food from the oil before they burn; then you can reuse the strained oil several times. When reusing oil, Oriental cooks often freshen it with a few slices of fresh ginger added to the oil while heating (be sure to remove ginger before it burns). Professionals may be able to judge correct

oil temperature without a deep-fat frying thermometer, but you will probably have better results using one.

Always make sure your wok is firmly supported in its ring base so it can't possibly tip when filled with hot oil, and adjust it on your range for the highest heat possible (see page 75). High heat keeps the oil temperature from dropping too low when cold foods are added. Handle a wok full of hot oil very carefully with both hands. Allow oil to cool before trying to pour it out of the pan.

When you coat foods, the trick is to choose a coating that will get nicely brown and crisp—but not burned—in the same time it takes the food to cook. Here's how to manage that when you fry chicken, fish, or vegetables:

Wok-fried chicken. Have ready 4 chicken

legs and thighs (joined or separated), 4 broiler-fryer chicken quarters, or 2 halves; wash and pat dry. Position wok on range for highest heat. Pour in 4 cups salad oil; heat to 375° (a cube of bread browns in 40 to 60 seconds).

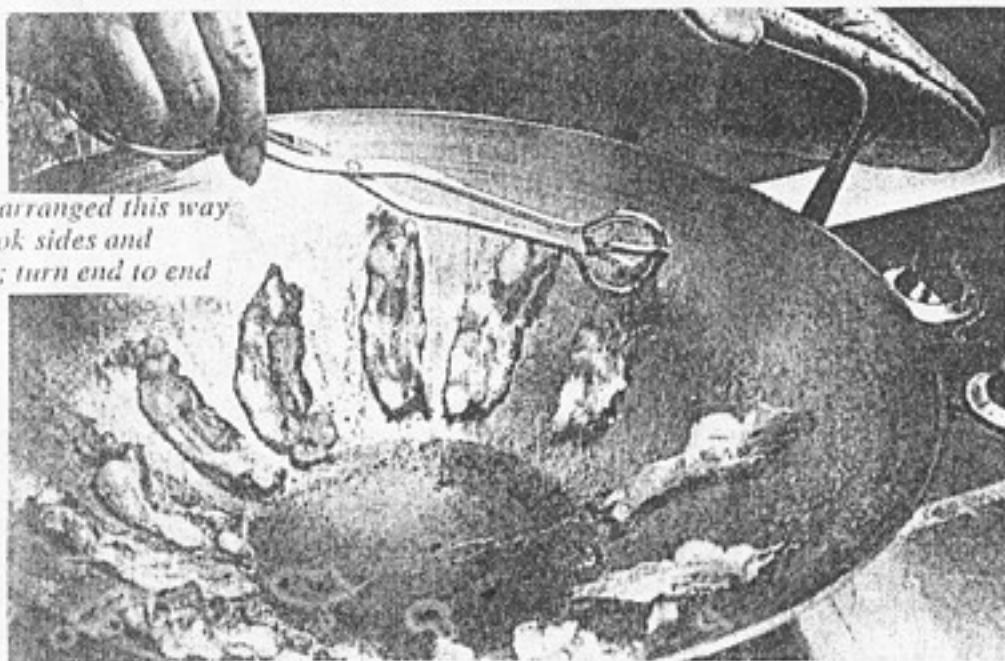
Meanwhile combine in a bag $\frac{1}{4}$ cup flour, 1 tablespoon cornmeal, $\frac{1}{2}$ teaspoon each salt and ground ginger, and dash of pepper. Shake chicken pieces in bag until coated all over; shake off excess flour. Carefully add one piece of chicken at a time to hot oil; cook, turning with tongs as needed to brown evenly all over, for 15 to 20 minutes. Drain briefly before serving. Makes 2 to 4 servings.

Fried fish, shrimp, or vegetables, Oriental-style. First prepare this light tempura batter: In a bowl, lightly beat 1 egg. Beat in until smooth 1 cup each unsifted flour

Carrots go into this braised beef dish; here's one way to arrange wok for cooking slowly on a gas range



Bacon half-slices arranged this way cook slowly on wok sides and drain into bottom; turn end to end



and cold water and $\frac{1}{4}$ teaspoon salt. Refrigerate or set inside a larger bowl of ice while you prepare any of these fish or vegetables for frying:

For the fish, use fillets of halibut, haddock, or rockfish (if frozen, thaw completely); cut into sticks about $\frac{1}{2}$ by 2 inches. Or shell and devein medium-sized raw shrimp.

For the vegetables, choose from onions, sliced $\frac{1}{4}$ inch thick and separated into rings; sprigs of fresh parsley; $\frac{1}{4}$ -inch slices raw mushrooms; edible-pod peas; green onions, cut in 2-inch lengths; eggplant, cut $\frac{1}{4}$ inch thick and quartered; asparagus, cut in 1-inch diagonal slices; small, tender spinach leaves; or carrots, in thin diagonal slices.

Position wok on range for highest heat. Pour in 4 cups salad oil and heat to 375° (a cube of bread browns in 40 to 60 seconds). Dip one piece of fish or vegetable at a time in batter to coat, drain briefly, then slip into the hot oil.

You can fry several pieces at a time, but

avoid overcrowding and lowering the temperature; turn as needed to brown evenly, about $1\frac{1}{2}$ to 2 minutes for each piece. Remove and drain briefly. Serve with chile sauce or soy sauce, if you wish. Batter is enough for 4 to 6 servings.

The wok as a steamer

Even if you now rarely use a steamer, a wok does steaming so easily that you may want to use steaming more often for some of your cooking tasks. For example, you can cook a piece of fish or some chicken breasts for salad in live steam as fast as in simmering water and with less flavor loss. Flavor accents can be added effectively by sprinkling the food with salt, pepper, or herbs; surrounding it with slices of onion, lemon, or ginger; or placing the food on a plate and drizzling over soy or other liquid seasonings.

A round cake rack is all you need to convert your wok to a steamer. Set the food directly on the rack or on a heatproof plate placed on the rack so there is room for the steam to circulate. Keep an inch or more of water simmering under the rack, and cover it with the wok lid. Al-

low about the same cooking time as for simmering in water.

Oriental bamboo stacking baskets for steaming make it possible to steam several foods at once. You buy each ring and the lid separately (see page 153). The lid for the baskets is designed to minimize condensation; if you use the metal wok lid, drops of water will form on it, so lay a piece of waxed paper or foil over the food being steamed. Here are a few other handy ways the wok steamer can save time in the kitchen:

Place boiled rice in cheesecloth-lined basket or wire strainer over steam to keep hot and fluffy for an hour or longer.

Steam individual custards or a flan instead of baking them; lay a piece of waxed paper loosely over tops of cups after placing on steamer rack.

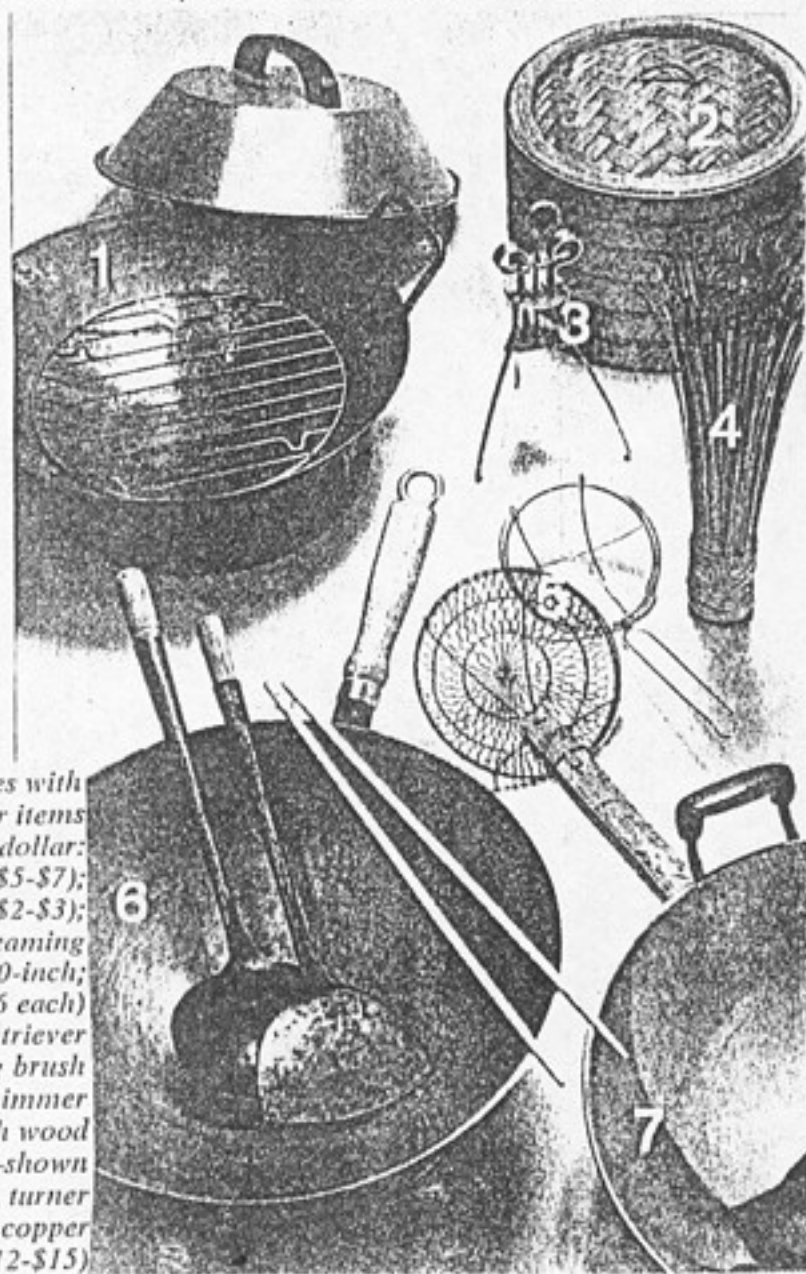
Reheat a covered bowl or plate of any prepared food such as stew, soup, cooked vegetables, slices of roast beef with gravy, or baked potatoes. Or reheat a plate of food (covered with foil) when someone in the family arrives late for dinner.

Stack steaming is a cooking discovery

COOKING WITH A WOK: Which wok and what other tools?



Chinese bamboo basket holds fish for steaming; baskets come in different sizes to fit woks, stack to cook a variety of foods



Array of woks and accessories with approximate price range (major items only) rounded to nearest dollar:

1. Rolled steel wok, 14-inch (\$5-\$7); lid (\$3-\$4); ring stand (\$2-\$3); cake rack for steaming
2. Bamboo steamer, 10-inch; trays and lid (\$5-\$6 each)
3. Steamed-dish retriever
4. Bamboo scouring brush
5. Wire ladle, screen-wire skimmer
6. Rolled steel wok with wood handle, 14-inch (\$5-\$7)—shown with chopsticks, ladle, turner
7. Stainless steel wok, copper bottom, 14-inch (\$12-\$15)

Which wok to buy? This may be your question if you have shopped for one lately, or if our story that begins on page 74 tempts you to try wok cooking.

For greatest versatility, buy the largest and heaviest wok you can handle easily, for you can cook a small amount of food in a big wok, but not the reverse. One that's about 14 inches across the top is good for most women; a man might prefer a 16-inch wok.

You can choose between woks with one wooden handle or the more common two-handled type. A two-handled wok has better balance and tips less easily, but a wooden-handled wok is easier to manipulate with one hand.

Of the woks pictured here, those at top left and lower left are made of rolled steel. This steel is an excellent conductor

of heat, but it will stain and rust like an iron frying pan. After using a steel wok for steaming, you will always have to clean some rust out of it. Some foods, like tomatoes and eggs, cooked in it may discolor or have a metallic taste. Even so, these woks are best for stir-frying and sautéing, and are used by most professional cooks.

Woks made of stainless steel are easy to clean and always rust-free, but this metal does a rather poor job of spreading heat across its surface—it gets hottest in the spots in direct contact with the heat. However this is not a problem when steaming, or frying in deep fat, or simmering a soup. The wok at bottom right in our picture is stainless steel with a copper bottom; copper improves the heat distribution, and we achieved fairly

good results when stir-frying in this pan. Because inexpensive, lightweight woks are available now in stainless steel or chrome-lined steel, you might consider buying one to use for steaming and moist-heat cooking. Then you can keep your rolled steel wok for frying and sautéing only, and it will become increasingly well seasoned as you use it—just as an omelet pan does.

Before using a rolled steel wok, rub it lightly with salad oil and put it into a 375° oven for about half an hour. Remove, cool, then scrub thoroughly.

The heavy bamboo brush shown below is an efficient tool for cleaning a wok after use. Other accessories are described in the caption.

Lentils make their contribution

Meet the lentils—those round, flat, thin seeds about one-fifth inch in diameter which expand in cooking to give robust body and interesting texture to soups and casseroles.

Lentils cook quickly without any soaking. One pound of lentils will expand to serve 8 persons in a casserole dish, more than that in a hearty soup.

Their flavor comes out best with an acid accompaniment such as tomatoes, catsup, or vinegar. These acids should be added after the lentils are cooked; added sooner, they are apt to delay the softening of the seeds.

Anchovies are the surprise addition to this substantial winter soup.

LENTIL SOUP

- 1 pound uncooked lentils
- 3 quarts stock or water
- 1 cup minced onion
- 3 tablespoons minced parsley
- ¼ cup (4 tablespoons) minced green pepper
- 1 clove of garlic, minced or mashed
- 1 tablespoon salt
- ¼ teaspoon pepper
- ½ teaspoon oregano
- ¼ cup (4 tablespoons) olive oil or salad oil
- 2 cups canned tomatoes
- 4 anchovies, finely chopped, or 2 teaspoons anchovy paste

Simmer lentils in stock or water in a large covered kettle for 1 hour. Sauté onion, parsley, green pepper, garlic, salt, pepper, and oregano in olive oil until onion is browned; stir into soup. Add tomatoes and chopped anchovies and simmer for 10 minutes to blend. Serves 12.—*L.N.M., Long Beach, Calif.*

This colorful lentil casserole is highly seasoned with onion and chili powder.

MEXICAN CASSEROLE

- 3 cups cooked lentils
- 1 cup canned tomatoes
- 2 tablespoons chopped green pepper
- ¼ cup chopped onion
- ½ teaspoon salt
- 1 teaspoon chili powder
- ¼ teaspoon garlic salt
- 4 strips bacon

Combine cooked lentils, tomatoes, green pepper, onion, salt, chili powder, and garlic salt in a 2½-quart baking pan. Arrange bacon strips over top. Bake in a moderate oven (350°) for 1 hour. Serves 4.

THE IMAGINATIVE COOK

Give a good glaze to broiled lamb chops by spooning a little chutney jelly over meat a few minutes before cooking is completed.



Two-minute potatoes

If you have a pressure cooker, you can reduce the cooking time for scalloped potatoes from an hour or more to just two minutes. Turn them into a casserole for oven-browning and a crusty top.

Pressure Scalloped Potatoes • Butter sides of pressure cooker (4 or 6 quart size) and place rack at lowest possible level. Cover with a layer of thinly sliced potatoes (use a boiling variety, if possible). Dust with flour, salt, and pepper, and dot with butter. Repeat layers until you have as many potatoes as you will need (fill pan no more than ¾ full). Almost cover with milk, or with a combination of half milk and half chicken broth. Cook (according to directions given for potatoes with your pressure cooker) for 2 minutes after pressure is reached. Run cold water over pan to reduce temperature. Turn potatoes into a casserole, sprinkle with shredded cheese or buttered bread crumbs, and place in a moderate oven (350°) or under the broiler until lightly brown.

Hang fresh red
California chiles to dry
where air circulates freely

Your own chile sauce from your own dried red chiles



Long festoons of shining red chiles, hanging decoratively to dry, are part of our Western culinary heritage. They belong to scenes in an early California mission or a southwest Indian pueblo—or even now in your own kitchen.

Begin by selecting slender, tapered California (also called Anaheim) chiles that have matured and turned bright red. (The immature California chile is green, and at this time of year both the red and green forms are available.) Each 6 to 8-inch chile should have a short stem and be blemish-free. If soiled wash chiles in cool water and dry well.

The drying process couldn't be simpler. Tie the stems onto a sturdy piece of twine, placing chiles close together, to create an attractive massed effect as shown above. Make the strand as long as you wish. Loop one end of the twine over a hook in an area that is dry, with air circulating freely around the strand. In several weeks, the chiles darken from their brilliant hue to a glistening red-black shade, and feel smooth and dry.

The strand can hang indefinitely. At any time you can use the chiles to make the following fine flavored sauce, with a gentle suggestion of hotness, to serve with Mexican-style dishes.

Red Chile Sauce

- 16 to 18 dried California (or Anaheim) chiles
- 3 cups hot water
- 1 clove garlic
- ¼ cup salad oil
- 1 teaspoon salt
- 1 teaspoon oregano leaves, crushed
- ¼ teaspoon ground cumin

Rinse whole chiles to remove dust; let drain until dry. Spread chiles out in a

single layer on a baking sheet. Place in a 400° oven for 1 minute; remove pan and turn chiles over. Then return to oven for 1 to 2 minutes more, or until chiles give off a lightly toasted aroma. Be careful not to scorch the chiles—this makes them bitter. Let chiles stand on baking sheet until cool.

Pull off and discard stems; remove seeds and any pithy material inside the chiles. Rinse chiles in cool water, drain briefly, then cover with the 3 cups hot water. Let stand at room temperature for 1 hour to soften. Then remove chiles from water and save the soaking liquid.

Place a few chiles at a time in a blender; add some of the soaking liquid and the garlic, and whirl, covered, until a smooth purée is formed. Repeat until all the chiles are puréed.

Combine purée with any remaining soaking liquid and pour through a wire strainer. Discard the fibrous residue. Blend purée with salad oil, salt, oregano, and cumin. Bring to a boil and simmer gently for about 10 minutes, stirring occasionally.

Store chile sauce in the refrigerator, covered, up to 4 days; or freeze for longer storage. Serve cold, or reheat, if desired. Makes about 3 cups.

Some ways to serve red chile sauce: Spoon the sauce, cold or reheated, into tacos, or over salad-style tostadas, tamales, huevos rancheros, or chiles rellenos. Stir into bowls of chile. Dip corn tortillas for enchiladas into the sauce before filling, then serve additional sauce with the finished enchilada dish. Spoon the sauce onto hot beef patties, steak, or scrambled eggs. □

How to sun-dry corn

Sometimes it's fun to prepare a dish the old-fashioned way just to find out how it was done and what it tasted like. Sun-dried corn is a case in point.

Homemakers used to dry summer's sweet, fresh corn in the hot sun, and then store the dried kernels in jars to use during the winter months ahead.

You may want to duplicate this old technique with August's abundance of fresh corn. It's still a practical way to preserve corn, and we think the hominy-like taste is a worthwhile reward.

SUN-DRIED CORN

Remove husks and silks from ears of corn. Drop corn in boiling, salted water, and cook just until the milk in the kernels

sets (about 5 minutes). Remove corn from water. When cool enough to handle, cut corn off the cob. Spread kernels in a single layer in a shallow pan and cover with a clean cloth.

Place the pan in direct sunlight (bring it indoors at night) until the kernels are thoroughly dry; this usually takes about two full days of sunlight. Store at room temperature in clean, covered jars or plastic containers, for up to six months.

To cook dried corn, rinse, cover with cool water, and soak overnight. Next day, cook in boiling, salted water until corn is tender (about 30 minutes). Drain; season with cream, butter, salt, and pepper before serving.—M. S., Portland.

Fresh butter, old-fashioned buttermilk, and fresh cottage cheese

For one special day, yours can be an old-time farm kitchen

Churn your own butter? Why bother? Besides, isn't it rather expensive?

Yes, it costs more (about twice as much per pound as commercially prepared butter). But we think that it's worthwhile to embark at least once upon the project of making butter. And we also recommend another old-fashioned project: the preparation of cottage cheese.

One excuse for these projects is to show children some of the activities that were commonplace in the farm kitchen of just a few decades ago, and to help them understand why recollections of that bustling room are such treasured memories.

But the best reason for making these readily available dairy products at home is that they taste good.

Nothing quite equals the melting flavor of soft butter, minutes old and still beaded with water, thickly spread on a slice of

good bread. And as long as whipped cream is favored as a dessert topping, there's little chance that the secrets of churning will be lost (beat the cream just a little too much, and it starts to turn to butter). The flavor of the finished butter—sweet, blatantly or delicately sour, salted or unsalted—depends on the age of the cream and the way you season it.

Butter-making will also yield the rare experience of tasting true buttermilk. It, too, will be sweet or tart according to the condition of the cream. Thin and butter-speckled, home-prepared buttermilk tastes and looks very different from the creamy, tart cultured buttermilk you buy.

The making of cottage cheese sounds like a more complicated process to the casual investigator, but the technique is really very simple. It had to be, or busy farm wives of years past would have found an

easier way to put their extra skim milk to use. The preparation of the milk takes time, but little personal attention.

This low-cost experiment (only a few cents more per pound than commercial cottage cheese) offers a good deal of leeway: You can make the cheese with large, tender lumps or with small, firm gran-

ules; you can leave it fat-free and unsalted, or add salt and a little cream for flavor and smoothness; and you can control the degree of tartness. The bowl of fresh cottage cheese will be delightful eating when you serve it just cooled by the last rinse of cold water, as an accompaniment for a tray of fruits or vegetables of the season.

Aside from the cheese itself, you will have a clear liquid called whey which is expelled as the solid curd of the cheese forms. Whey is very nutritious, but is not especially palatable unless used in cooking. For several examples of the ways in which whey was once commonly used, see the story on page 169.

Making butter

Buy pasteurized whipping cream; one quart will make about one pound of butter and approximately one and a half cups of buttermilk.

You can use the cream while it is sweet or let it sour to give more tang to the finished butter. Sweet cream butter has an extremely delicate and mild flavor; those accustomed only to commercial butter usually find sweet cream butter bland at first, but it's an easily acquired taste.

To sour the cream, or develop acidity, heat cream until it feels barely warm to touch. Pour into a bowl and stir in an acid-starter (3 tablespoons cultured buttermilk to 1 quart of cream); this insures clean, tart flavor. If you allow the cream to sour naturally, an acid bacteria that produces off flavors may grow.

Let cream stand, covered, in a warm place (about 80°) overnight or longer. Tasting is a good way to check its progress. The longer it stands, the more tart it becomes; cream that is aged for 12 hours is usually only a little sour to taste and smell, and the butter it makes is not a great deal stronger in flavor than that made from sweet cream. After 36 to 48 hours, the cream should have formed an almost solid crust; it will have a very sharp smell and sour flavor. The butter will have a noticeable piquancy. Chill the soured cream before churning.

Salt, for flavor, is also a matter of taste, so sample and see how you like it best.



Freshly churned butter and a slice from loaf of good bread deserve concentrated attention they're getting here. Homemade buttermilk completes an incomparable snack

SUNSET

SEPTEMBER 1963

FRESH BUTTER

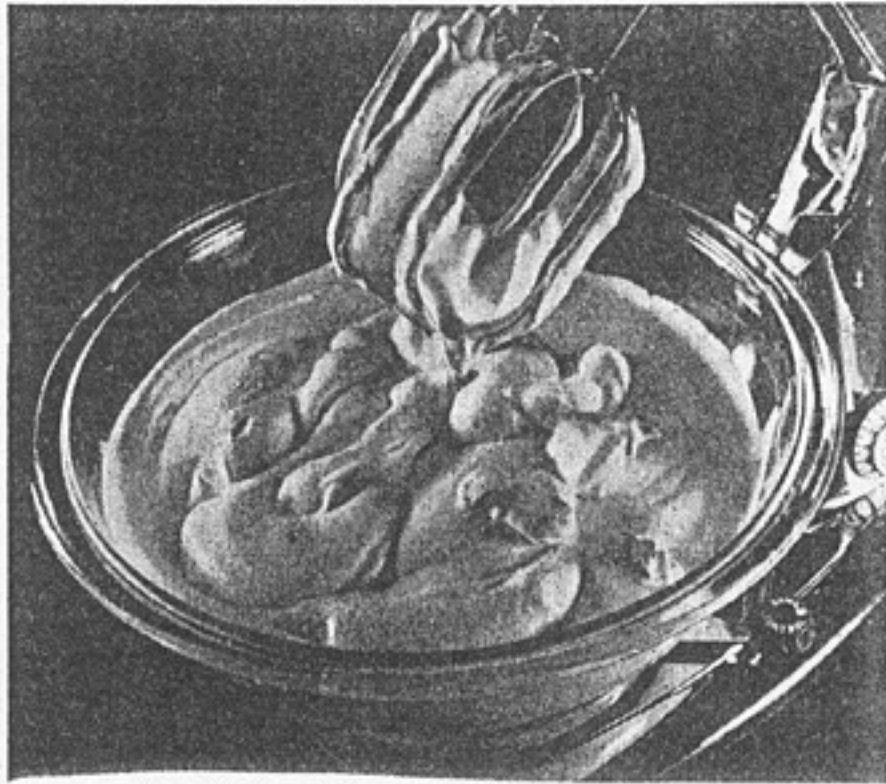
1 quart sweet or soured heavy cream, chilled
Cold water
Salt to taste (optional)

Pour cream into large bowl of an electric mixer and set at medium speed. Whip until small lumps of butter form and the thin buttermilk is floating among the butter particles. This takes 25 to 30 minutes; the mixture spatters during the last stages, so you may want to cover the mixer and bowl loosely with foil. Push cream from sides of bowl occasionally with a rubber spatula.

Strain butter and measure the buttermilk. Save buttermilk for drinking later, and add its equal measure of cold water (from the faucet) to the butter. Stir well; strain off and discard water. Repeat this washing process until water is clear.

Using a heavy wooden spoon, work as much water as possible out of butter, draining off liquid as it accumulates. Add salt if you wish (1 to 2 teaspoons or to taste) and work evenly into butter. Pack butter into a bowl and serve immediately, or cover, chill, and serve as you choose. Makes about 1 pound.

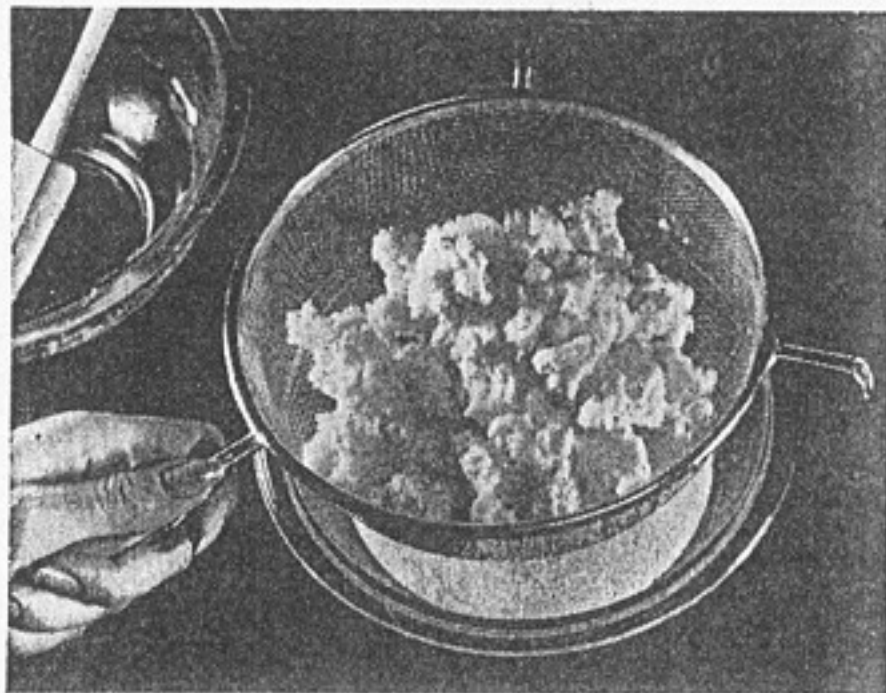
MAKING BUTTER: *With your power mixer it's easy. These are the basic steps*



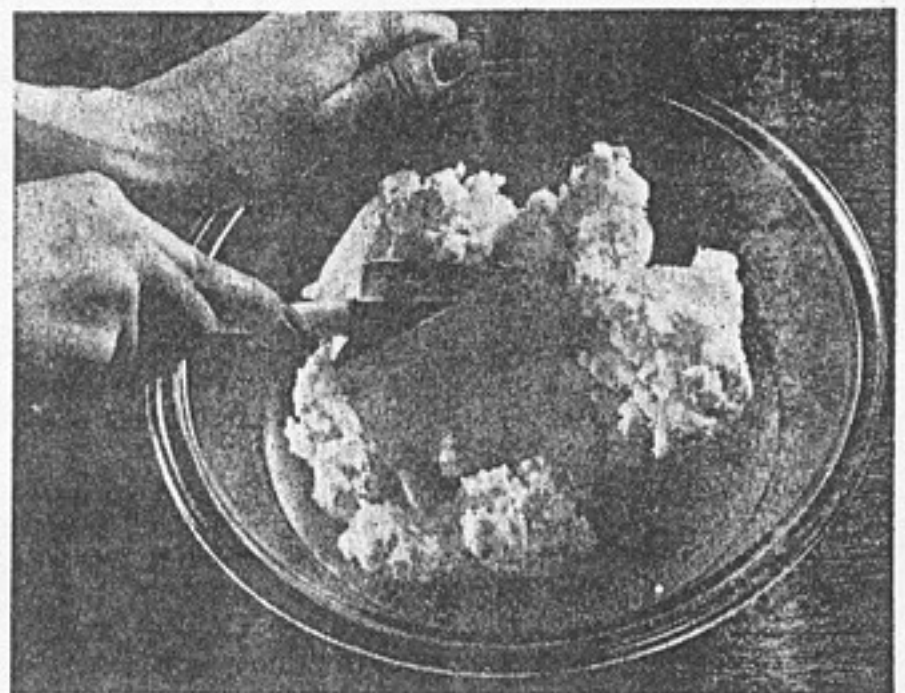
1. Fluffy mounds of whipped cream: an easily recognized stage in the changes that occur when cream is churned to make butter. Let the children sample the smoothness now



2. Finally the golden lumps of butter stand free, separated from the buttermilk. If you taste thick cream just preceding the butter, you can detect forming butter grains



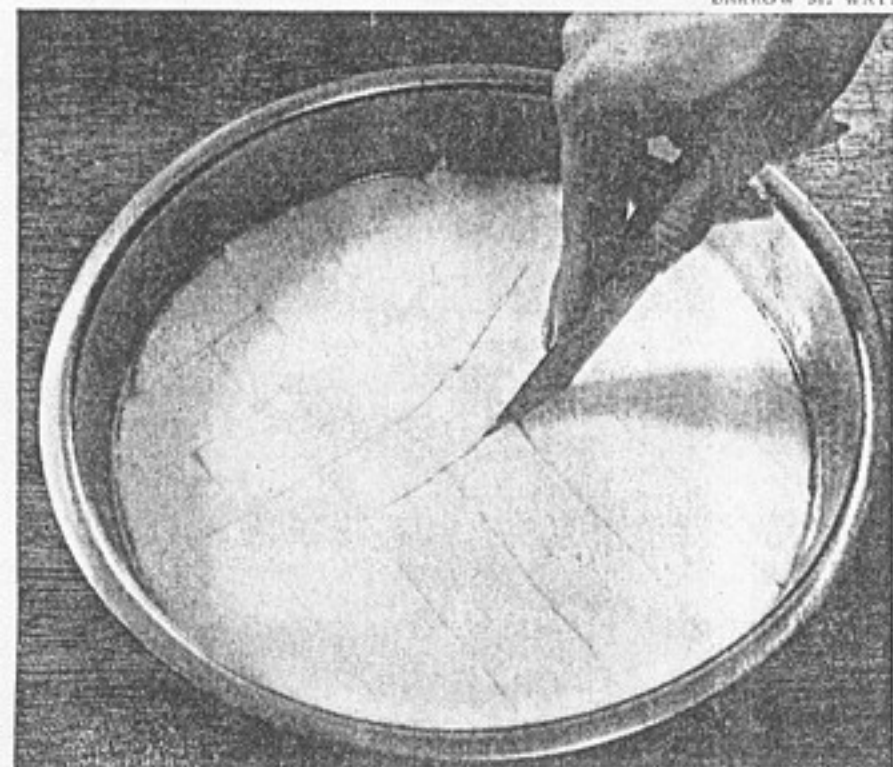
3. Let buttermilk drain from the butter. Save and chill this liquid to drink later. Turn lumps of butter into a bowl; add cool water from the faucet for washing soft butter



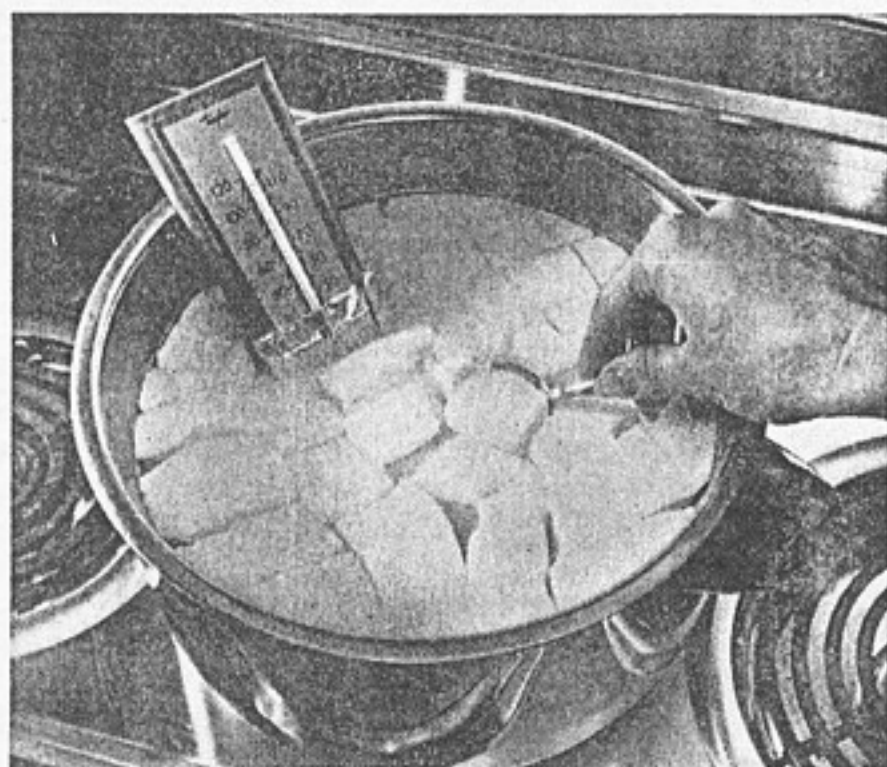
4. Work butter in cool water with a spatula or spoon, squeezing out pockets of buttermilk. Change waters until milk no longer colors. Drain, work out excess water in butter

MAKING FRESH COTTAGE CHEESE: *You slice up the curds, heat them,*

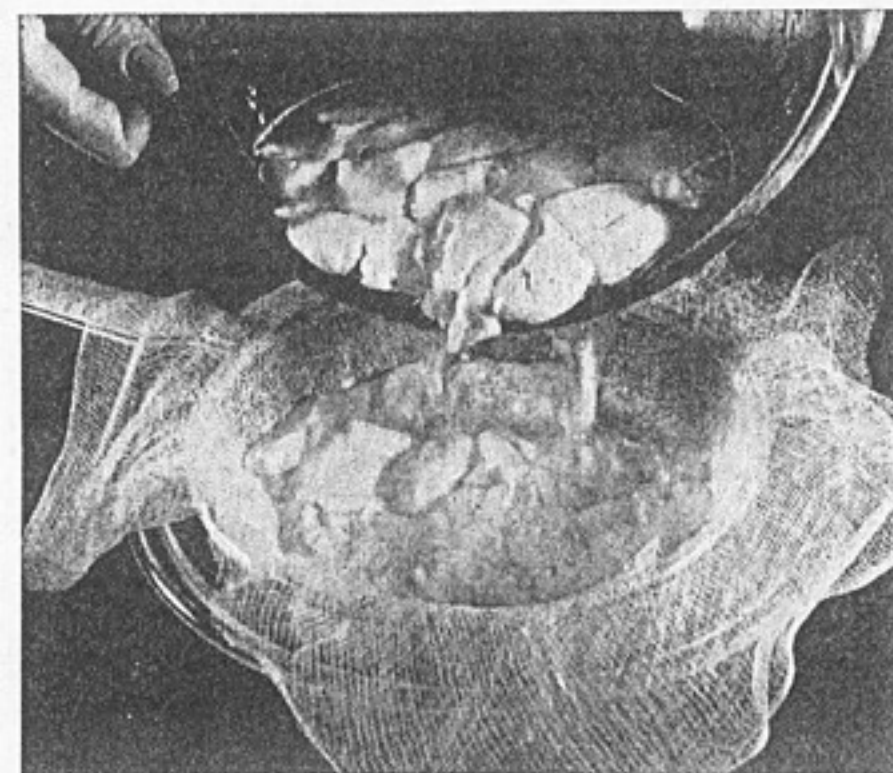
DARROW M. WATT



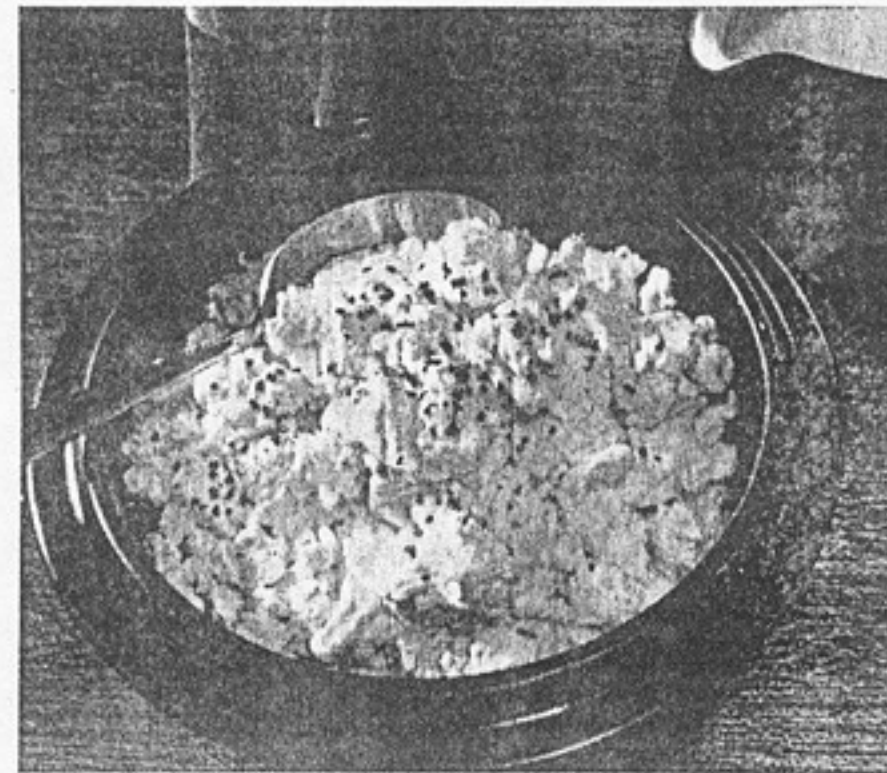
1. *Cut curd for cheese, made of skim milk soured overnight, into 1-inch squares for large curd cottage cheese (or $\frac{1}{4}$ -inch squares for small curd cheese). Note whey at edges then drain away the whey. Rinse and your cottage cheese is ready*



2. *Slowly heat curds and whey over hot water, occasionally stirring gently; takes about 2 hours. Use candy thermometer to check progress, or a wall thermometer in foil*



3. *Turn heat-firmed curds into cheesecloth-lined strainer. Let stand until whey ceases draining. Gently pour cold water over cheese to cool and wash out remaining whey*



4. *Serve freshly made, cool, large curd cottage cheese seasoned with salt, coarse black pepper (if you wish), and enough cream (light or heavy) to moisten to your taste*

Making cottage cheese

There are many ways to make this mild uncured cheese. The method we have selected requires no special equipment, and it lets you depend upon physical observation of changes taking place to determine what to do next, rather than upon some of the old-fashioned "feel" or "know-how" techniques that come from accrued experience.

For this reason our directions may seem unduly detailed to cooks who remember simply setting a pan of soured skim milk on the back of a wood stove and taking it off when the cheese was "ready."

Cottage cheese is made only from skim milk (whole milk makes another kind). It is soured to develop a quasi-solid

called the curd, and the characteristic acid flavor. Because pasteurization will have destroyed souring (or lactic acid forming) bacteria that are naturally present in skim milk, it is necessary to introduce a culture; for this, all you need is a few tablespoons of cultured buttermilk. The formation of the curd takes about 16 hours in a warm place; ordinarily you can

set the milk to sour in the late afternoon and plan to finish the preparation the next morning—in time to have fresh cottage cheese for lunch.

When you cut the curd (into either large or small pieces), a certain amount of whey drains out. Other cheeses are made by simply draining the curd in a bag, but for cottage cheese the mixture is heated gently; this firms the curd, which literally squeezes out more of the acid-tasting whey.

Slow heating is necessary, with temperature checked with a thermometer. A candy thermometer includes an adequate temperature range. Otherwise, an ordinary wall thermometer that registers temperatures up to about 120° will do; to protect both wall thermometer and cheese mixture, wrap the base in foil, sealing watertight.

After the curd is properly firmed, washing cools the cheese and rinses away the remaining free whey.

Two quarts of skim milk usually yield two cups or one pound of cottage cheese.

FRESH COTTAGE CHEESE

- 2 quarts cold skim milk
- 3 tablespoons cultured buttermilk
- Cold water
- Salt to taste
- 2 or 3 tablespoons light or heavy cream (optional)

Heat skim milk until it feels warm to touch (from 90° to 100°); pour into a stainless steel bowl or enameled pan. Stir in the buttermilk. Lightly cover pan and set in warm place (between 70° and 80°) for about 16 hours, or until the milk forms a solid curd similar in consistency to a very fragile baked custard. You should be able to see the whey floating around the edges and on the surface of the curd.

With a long knife, cut down through the curd in a grid pattern (see photograph 1, left above). For large curd cheese, make squares measuring about an inch; for small curd, about $\frac{1}{4}$ to $\frac{3}{8}$ inch. Then, so you'll have pieces about as thick as they are broad, tilt the knife toward the horizontal and make several diagonal cuts. Place pan in another container of hot water (from the faucet) and heat very slowly to 120° to 130°; have heat at the lowest or next to lowest setting on your range. Total cooking time should be about 2 hours; if curds reach the proper temperature much before this

time, leave over the hot water but do not allow temperature to go higher. Gently stir six or seven times to distribute heat; break curds as little as possible.

To test consistency of the cooking curds,

put about a teaspoonful in a cup of icy cold water. When cool, break curd apart. If it breaks cleanly and texture is as firm inside as out, the curds are ready to drain; if still milky looking, continue cooking. Line a large wire sieve or colander with two or three thicknesses of cheesecloth. Pour in curds and let stand until whey stops draining (save whey if you wish). Gently pour over cold water to cool the

curds and wash out remaining whey. If you want the cheese to have a decidedly bitey flavor, taste during washing; when it has the flavor you want, stop washing it. Let stand a few more minutes to drain completely. Season with salt. Blend in cream if you like the richness it gives. Serve immediately or keep cold, covered, until ready to eat. Makes about 2 cups.



Homemade dill pickles are easy, once you've assembled the basic ingredients: large stone crock with a lid, fresh dill, mixed pickling spices, cider vinegar, salt, and water

September's the time to make old-fashioned dill pickles

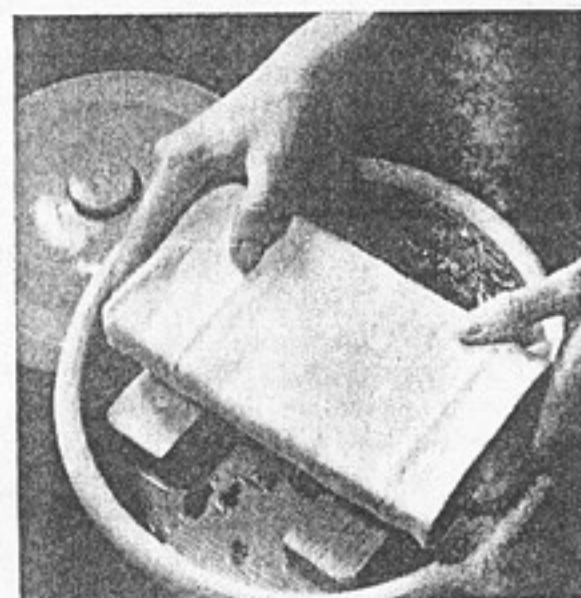
OLD-FASHIONED DILL PICKLES

First stage: Brining

- About 20 pounds pickling cucumbers
- 1 large bunch fresh dill
- 2 packages ($1\frac{1}{4}$ oz. each) whole mixed pickling spice
- About 10 cloves garlic (optional)
- $1\frac{1}{2}$ cups table salt (not iodized)
- 3 cups cider vinegar
- $2\frac{1}{2}$ gallons (10 quarts) soft water

Wash, scrub, and drain cucumbers. Rinse dill and cut off heads, discarding stems. Place half the spices, dill, and garlic (if used) in the bottom of a clean, 5-gallon stone crock or other container suggested at left, below. Add cucumbers and remaining dill, spices, and garlic (if used). Mix salt, vinegar, and water, and pour over cucumbers. Weight down (see below). Cover and store in a cool, dark place.

Check pickles frequently, removing any scum with paper towels. After 10 days, rinse and taste one pickle; if it isn't as



To keep pickles submerged, use inverted plate with water-filled glass jar weight, or cut round of clear pine to fit inside crock; nail blocks to round piece to hold the towel-wrapped brick weight above brine

crisp and flavorful as you wish, let pickles ferment longer. Check again daily until they are as you like them (10 to 20 days).

Second stage: Packing and processing

- 1 large bunch fresh dill
- $\frac{3}{4}$ cup table salt (not iodized)
- $1\frac{1}{2}$ cups cider vinegar
- 5 quarts soft water
- 1 package ($1\frac{1}{4}$ oz.) whole mixed pickling spice
- About 10 cloves garlic (optional)

The sight of an old-fashioned pickle crock may take your thoughts back to grandmother's house or an old country store. You can easily duplicate the crunchy, sour dill pickles of those days in your own kitchen; and the supply of pickling cucumbers is plentiful now.

The pictures on this page show the two main steps in "putting down" a crock of pickles. Our recipe calls for about 20 pounds of small pickling cucumbers and a 5-gallon stone crock.

We also recommend heat processing for the brined pickles. When they have reached the proper level of fermentation

(in 10 to 20 days), you pack the pickles in sterilized jars with fresh brine and spices and process them in a boiling water bath. If timed accurately, the pickles will remain crisp.

Here are some pointers to follow when making these brined dill pickles:

1. Use fresh pickling cucumbers (salad cucumbers don't make good pickles).
2. Use a stone crock, wooden keg, or container of aluminum, enamel, glass, or stainless steel (don't use iron, copper, zinc, or galvanized utensils).
3. Use regular table salt (not iodized), a commercial cider vinegar (4 to 6 per cent acidity), fresh herbs and spices, and soft water.
4. Be sure to discard soft, slippery, white-spotted, or moldy pickles.
5. Use standard canning jars and self-sealing lids.
6. Sterilize jars by boiling; keep hot in simmering water until ready to fill.

This recipe for old-fashioned dills is pre-

sented in two stages. The first is the brining of the pickles, which takes two to three weeks. The second stage includes packing and processing the pickles in jars.

Rinse dill and cut off heads, discarding stems. To prepare pickles, drain off brine, wash pickles in cool running water, and drain. Then combine salt, vinegar, and water for the packing brine; bring to a boil. Fill each jar with pickles; add 1 head of dill, $\frac{1}{2}$ teaspoon pickling spice, and 1 clove garlic (if used). Pour in enough fresh, hot brine to cover pickles. Adjust caps and place jars in boiling water to cover about 1 inch. Process (boil) 15 minutes. Remove from water and cool. Check seals; store in cool area. Makes about 10 quarts.

Making your own apple cider is an activity the whole family can enjoy. And, though time consuming, the process is surprisingly simple. All you need is a small cider press that you can either build or buy, a food chopper, and a box or two of apples.

The fresh juice that flows from the fruit is ready to sample immediately. At first homemade cider is opaque and dark brown (not clear and light amber as in most preserved cider you buy), with a flavor well worth your time and effort. On standing, the cider becomes tangy and clearer as the suspended solids settle to the bottom of the container.

A 30 to 35-pound box of apples will make about 2 gallons of cider. Select only firm, fully ripe fruit. Unripe apples give the juice a starchy flavor and a white claylike sediment; apples with spots of decay can give a definitely moldy taste.

Cider making lends itself to assembly-line techniques.

First wash the apples in a tub or pail of water to remove spray residue and dust. Then cut into quarters and remove any bruised or bad spots, and if you are using sprayed fruit, cut away the stem and blossom ends. Do not peel or core. Place the cut apples in large crocks, bowls, or kettles (avoid containers made of iron or toxic materials such as zinc or galvanized sheet metal).

Next grind apples with a food chopper. This step itself supplies a good deal of juice. Lay four thicknesses of damp cheesecloth loosely across the top of a large container; hold in place with clothespins or string. Place this container directly under the food chopper to filter and catch the juice that will flow

SUNSET OCTOBER 1971

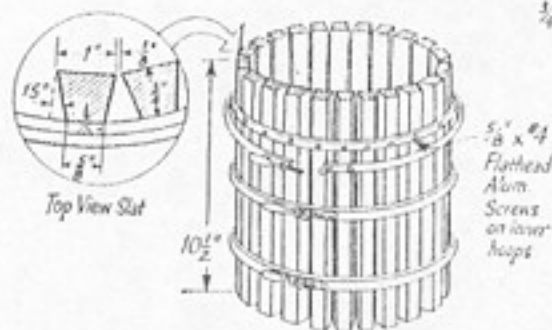
Pressing your own cider

What you need is a press and some apples.
What you get is delicious and with waiting it gets better



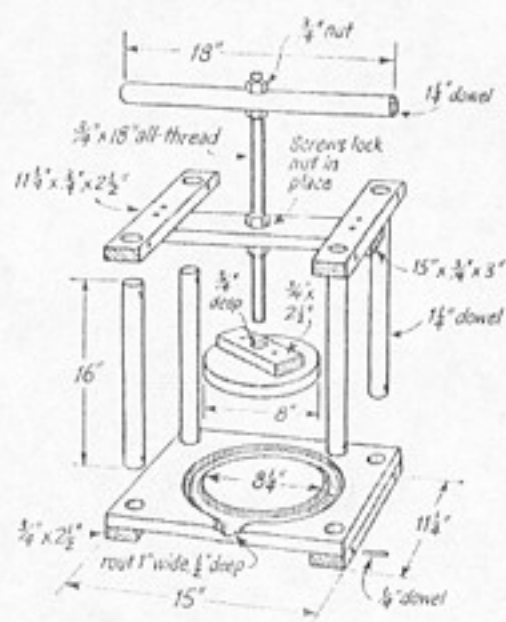
Apple juice flows from press through cheesecloth into kettle. Young lady does first step: grinding apple quarters

Making your own slat-basket cider press



The fruit press shown here costs about \$15 to build. Most of it is 3/4-inch oak. Three 10-inch embroidery hoops hold the basket round. Hardwood dowels serve as side supports. A piece of 3/4-inch all-thread, threading through hex nuts, provides the drive for the press. Make the juice groove with a router or chisel.

The pieces are joined with waterproof glue, strengthened by 1/4-inch



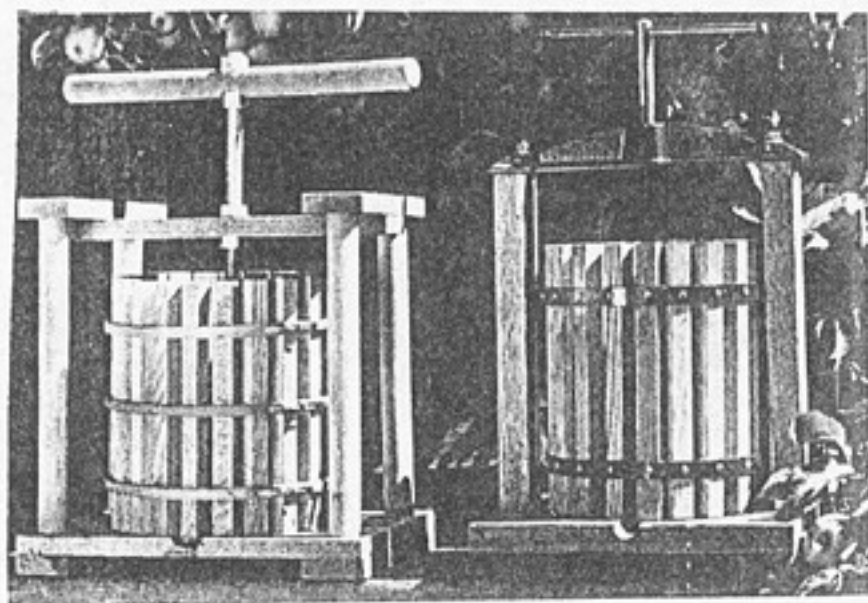
dowels at critical points. The only screws are those that hold the basket slats to the inner half of the embroidery hoops. These screws should be either aluminum, chrome-plated, stainless steel, or tin-plated. Do not use toxic brass, zinc-plated, or cadmium-plated screws. If the embroidery hoops have metal fasteners, coat them with plastic urethane or any other finish that will cover the toxic metal.

from the back of the chopper. Using the medium blade, grind the apple quarters, catching the pulp in another container.

For the pressing, you may use the same cheesecloth-topped container (if all the grinding is complete) or prepare another container with cheesecloth to catch juice under the groove spout of the press. Fill the press basket about half full of ground apples. Cover with the press plate and turn the drive handle slowly to force the juice from the pulp, compressing it to about half its original volume.

Cider is good fresh, but even better in about a week when it has developed some sparkle and tang. You can store it in the refrigerator for as long as three weeks or freeze it for longer storage.

We built several small presses and found that the one below, modeled after the traditional slat-basket fruit press, is most successful. If you own more than a few apple trees, you might want to build or buy a larger one. □



Fruit press at left can be built for about \$15 (see instructions below). Press at right costs about \$40; available from firms selling winemaking equipment



Cider fresh from press tastes robust and fruity, looks dark and cloudy, will clear up later

Sprouts grow in your kitchen

We report on 10 kinds to grow for garnish, or as ingredients. You get results almost overnight

SUNSET FEBRUARY 1974

Growing your own sprouts from seeds is almost like having a vegetable garden in the kitchen. You get a crop rain or shine, easily, neatly, and quickly—in two to seven days.

Many people are familiar with mung bean sprouts (the "bean sprouts" sold at grocery stores) and alfalfa sprouts. We'd also like to introduce you to kinds you may never have heard of: chia, cress, fenugreek, lentil, mustard, radish, rye, and wheat. Out of 31 kinds of sprouts we tried, these are easiest, most reliable, and most appetizing.

Below you'll read how to grow sprouts. On page 130 are suggestions for using them. Once you know their characteristics you can toss them into foods as freely as you use onions or parsley. They can serve as garnishes or as substantial ingredients in salads, breads, and vegetable and meat entrées.

The nutritive value of these and most other sprouts hasn't been officially investigated yet, but private tests so far indicate that vitamins increase and calories decrease when a seed is sprouted.

How to grow sprouts

The chart and photographs on following pages give you most of the information you need—size and appearance of each sprout when ready to eat, its taste, how much different seeds will yield, what containers to grow them in.

There are two basic types of sprouts. There are tiny ones that you eat when they form green leaves: alfalfa, cress, chia, mustard, and radish. And there are larger ones that you eat before the leaves open or turn green: fenugreek, lentils, mung beans, wheat, and rye.

You sprout both kinds in almost the same way. Discard broken or unhealthy-looking seeds. Soak whole seeds in about three times their volume of water until they are saturated. Tiny seeds become saturated in a few hours; large ones take overnight. Drain off water that hasn't been absorbed, and keep seeds in a warm place (68° or slightly warmer).

Keep the seeds moist by rinsing or spraying with lukewarm water two to four times a day. When seeds pop, give leafy green sprouts plenty of light.

Lentils, rye, and wheat can grow in light or dark. Keep mung beans and fenugreek dark and water often; otherwise they develop an unpleasant "green" flavor. Mung sprouts also require constant warmth to look and taste like commercial ones. Many people eliminate difficulties with mung sprouts by using them when ¼ to 1 inch long instead of waiting until they reach commercial size (2 to 3 inches). These immature mung sprouts have a mild legume flavor that brief cooking brings out nicely.

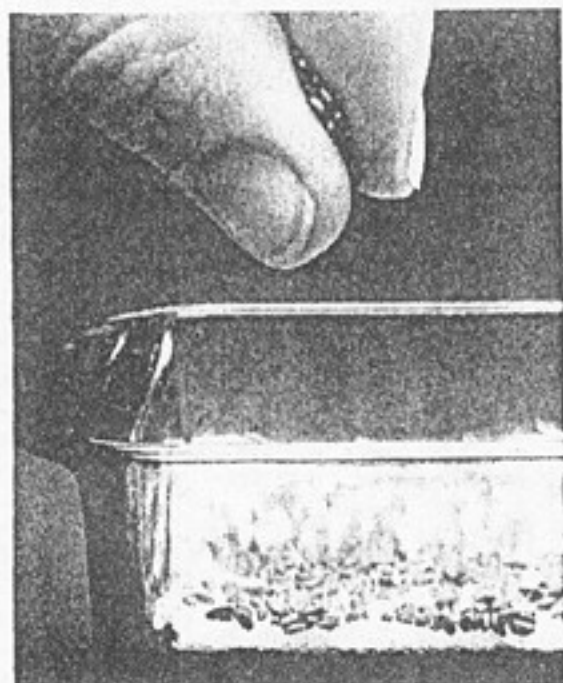
Sprouts generally taste best and have most nutrients if you use them soon after they reach mature size, shown on page 66; exceptions are mung sprouts, which you may prefer to use when they're smaller. Rinse off loose seed hulls, or use hulls and all.

If it's necessary to store sprouts, refrigerate them in a firm, air-tight container. Sprouts keep a few days to over a week depending on how dry they are when stored and how cold your refrigerator is. With sprouts that develop roots, snip off tops and stems just before serving.

Except for cress and radish, you can buy these seeds in quantity at most health food stores; lentils and wheat berries are also sold in grocery stores.

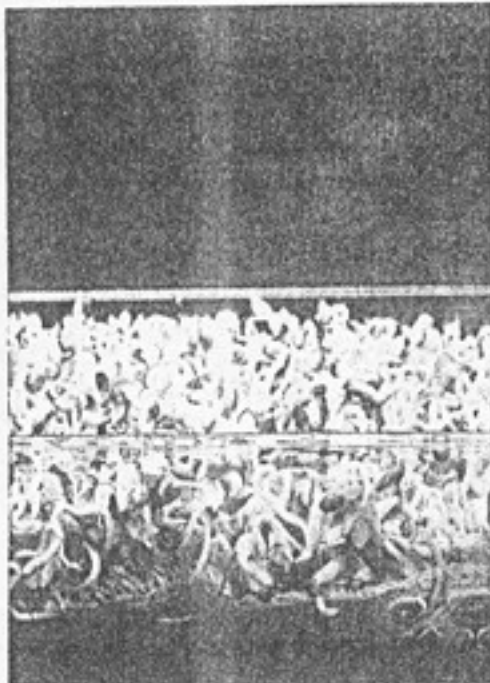
What to sprout seeds in

You don't need any special containers.



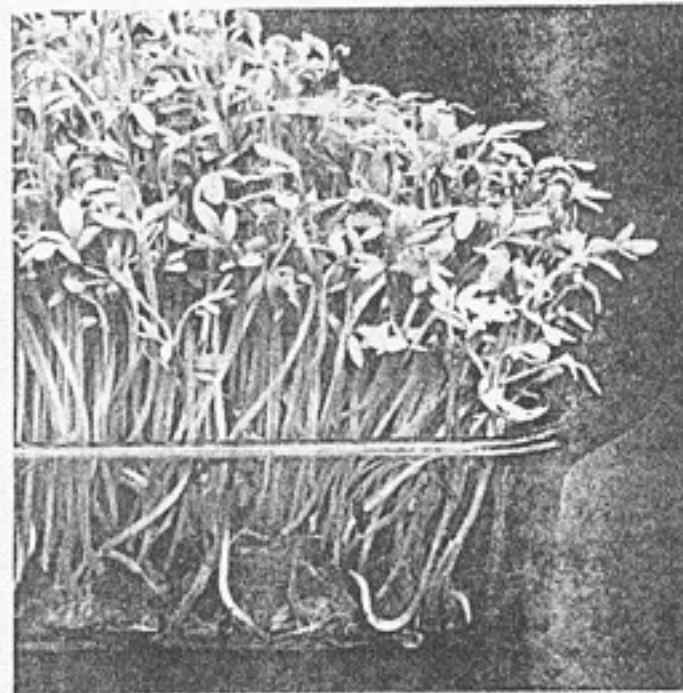
DAY 1

To grow leafy green sprouts, scatter seeds thickly over wet cheesecloth in shallow pan. Sprinkle with water



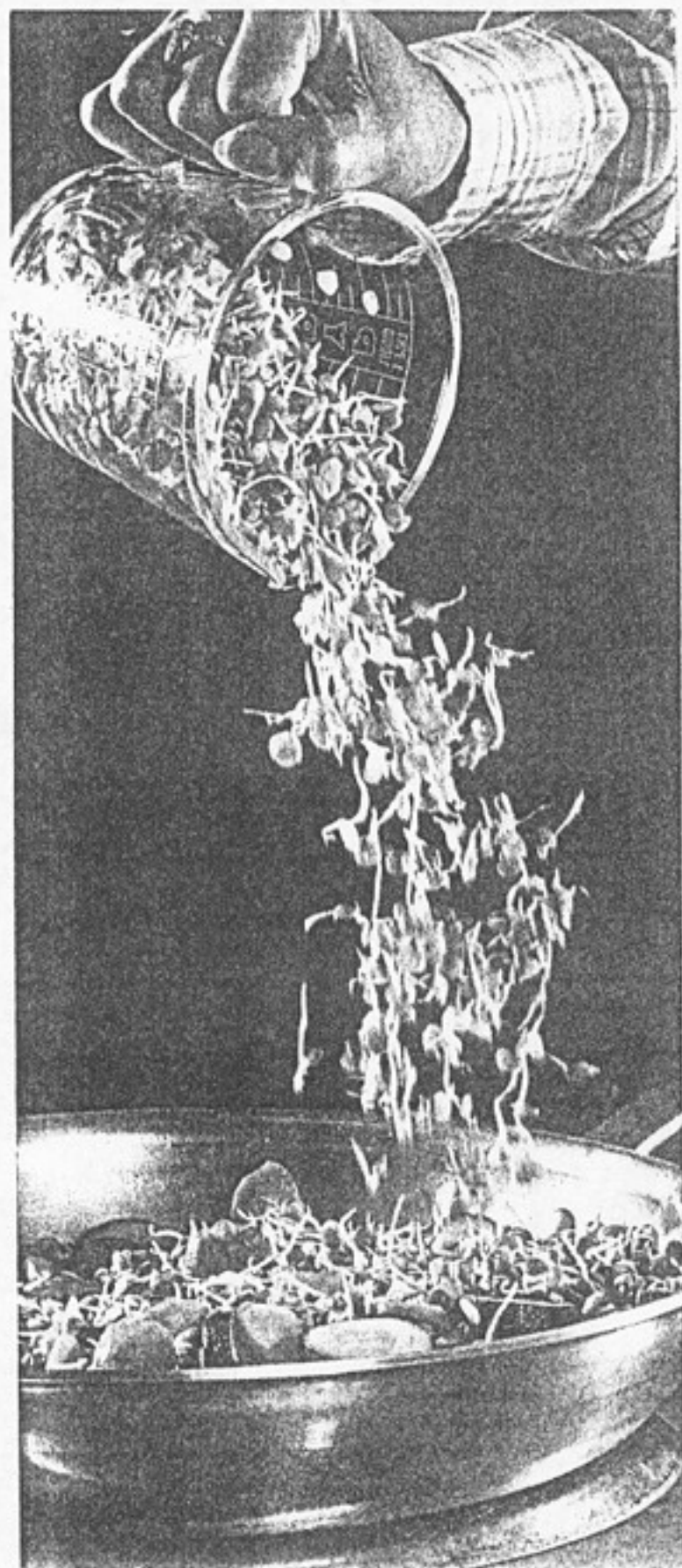
DAY 2

Sprouts have popped out of seeds. Give them plenty of light and keep moist



DAY 5

Ready-to-eat, cress sprouts are 2 inches tall with fully opened, bright-green leaves

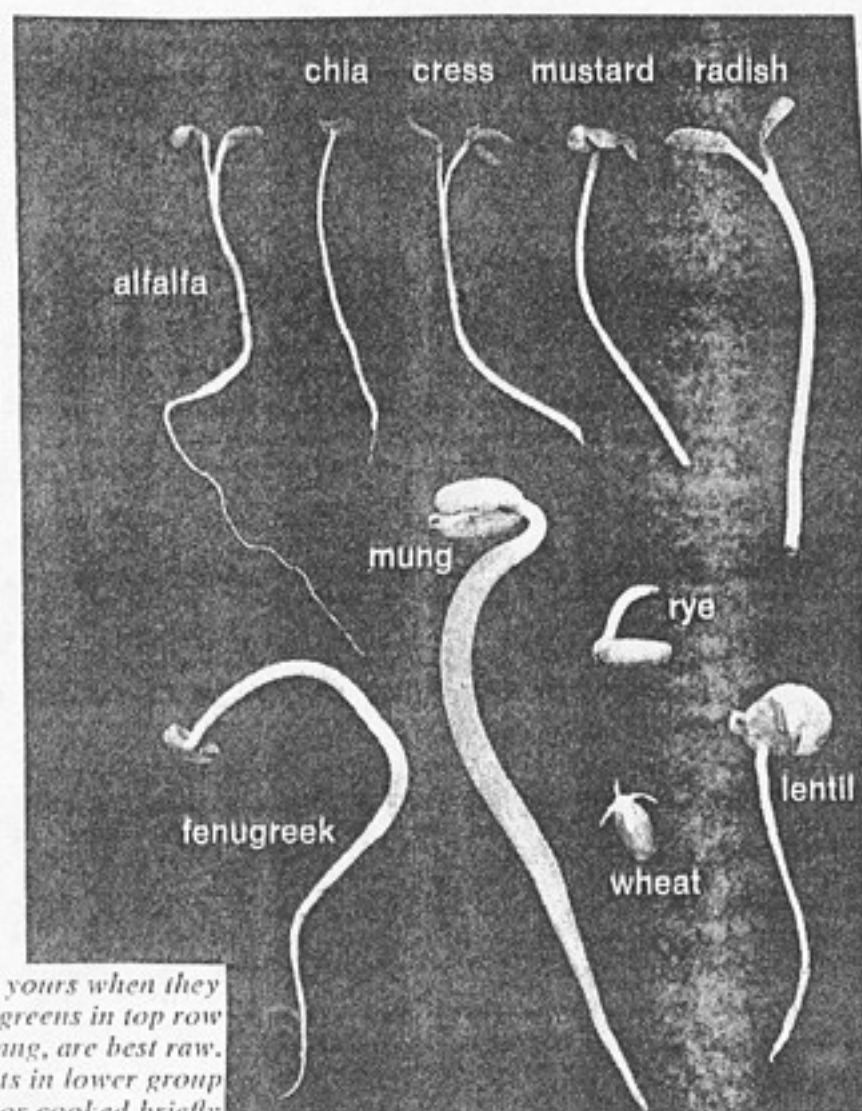


Sprouted lentils took two days to reach this stage. They cook quickly. Add at the last minute to butter-steamed vegetables for new flavor and texture

Experienced sprout enthusiasts can and do grow sprouts in or on almost any kitchen container, including plates, bowls, and roasting pans. But for most people, containers that drain easily, such as those shown at lower right, are more convenient and more likely to give uniformly successful results. Each has its own advantages.



Snippets of mustard and cress garnish cream cheese on crackers; or use in sandwiches or salads



Life-size sprouts. Harvest yours when they look like this. Leafy greens in top row add crisp subtle tang, are best raw. More substantial sprouts in lower group are good raw or cooked briefly

You can easily adapt containers you may already have:

Shallow dishes with cheesecloth can be used to grow all five green sprouts. Make sure dishes are not metal. Spread one layer of seeds over several thicknesses of cheesecloth (paper towels will do).

A *colander* is good for growing any of the larger sprouts. Soak the seeds overnight in another container first, then put them in the colander and rinse two to four times a day until ready to use. Cover with a towel to reduce evaporation and hold warmth. Rest on a plate to catch drain water.

If you prefer to buy a sprouter, you're most likely to find one in a health food store. Occasionally they're sold in hardware stores or kitchenware stores.

A *screen-lidded jar* is the most popular and widely sold. You can buy screened lids or easily make them yourself with wire or fiberglass window screen fitted into a jar ring. Use a wide-mouth can-

ning jar. Submerge seeds in water overnight, drain the water through the screened lid, and rinse seeds with water several times a day.

The *sprout pail* (not widely available) operates the same way, but gives better ventilation and easier removal of bulky seeds; it's also useful for sprouting quantities of small seeds. It has holes in the bottom similar to those in its lid and a circle of fiberglass screen fitted into the bottom for drainage and air circulation. You put seeds into the pail after soaking them in a different container.

Sprouting jars and pails are particularly convenient for growing the quantities of alfalfa many people use; they are not at all suitable for seeds that get sticky when wet—chia, cress, a few kinds of mustard (these hold too much moisture).

Sprouting trays are suitable for all seeds, but not roomy enough for large quantities of most seeds. Grooves in the bot-

tom of each tray hold seeds above moisture. Stacking the trays and putting on the lid retains moisture, holds in heat generated by the sprouting seeds, and saves counter or shelf space. You can grow different sprouts in each of three trays, stagger starting times in each tray for a continuous harvest of one kind, or start small amounts of one seed in all three trays at once to get a larger quantity. You'll have to finish growing most sprouts uncovered, because they bump the lid before reaching harvest size. We consistently had to drain off water by tilting trays with the lid held on because air bubbles plugged drain tubes.

Mexican clay animals—goat, ram, platypus, and more—are useful only for two kinds of seeds that naturally get sticky when wet: cress and chia. The animal's sides are scored to help seeds stick. Mix about 3 tablespoons of seeds with 4 to 5 tablespoons of water—just enough to make a gluey paste when you stir them.

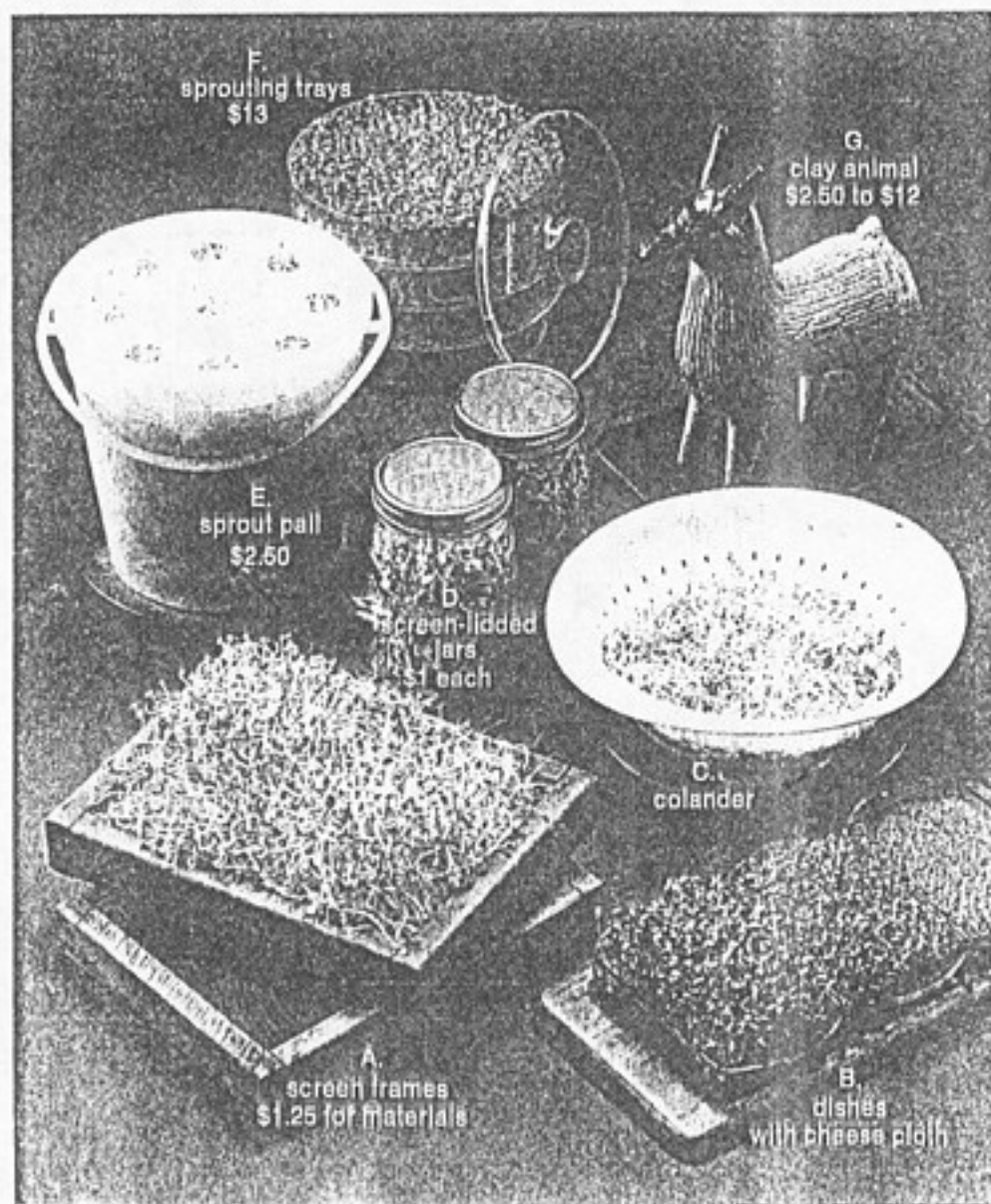
We tested 31 sprouts. These 10 were winners

LEAFY GREEN SPROUTS: use them in salads or as a garnish

	Growing time	Harvest size	Yield (seed)	Yield (sprouts)	Taste	Which containers
alfalfa	3 to 5 days	1½ to 2"	1 Tbs. makes 4 cups		crisp, mild, grassy	B, D, E, F
chia	4 to 6 days	1½ to 2"	1 Tbs. makes 2 cups		full-bodied flavor distinctly its own	B, F, G
garden cress	3 to 5 days	1½ to 2"	1 Tbs. makes 2 cups		peppery, similar to watercress but milder	B, F, G
mustard	5 to 6 days	1½ to 2"	1 Tbs. makes 2 cups		pleasant bite, similar to mustard greens	B, D, F
radish	2 to 5 days	1½ to 2"	1 Tbs. makes 2 cups		strong radish flavor, gets hot when older or watered infrequently	B, D, F

LARGER WHITE SPROUTS: in breads, entrées, salads

fenugreek	4 to 6 days	2 to 3"	1 cup makes 12 cups		similar to mung but slightly bitter	A, C, D, E, F
lentil	2 to 4 days	¾ to 1½"	1 cup makes 6 cups		mildly spicy, fresh vegetable flavor and crunch, slightly starchy when raw	A, C, D, E, F
mung bean	1 to 5 days (immature) 5 to 7 days (commercial size)	¼" and up 2 to 3"	depends on harvest size; 1 cup makes 5 to 12 cups		pleasant legume flavor, crunchy bland, crunchy	A, C, D, E, F
rye	2 days	¼"	1 cup makes 4 cups		similar to wheat but more subtle flavor, less substantial	A, C, D, E, F
wheat	2 days	¼"	1 cup makes 4 cups		sweet, nutty, chewy, very filling	A, C, D, E, F



Containers for sprouting; you can make some, buy others. See chart at left and text to find out what each is best for

Spread the seeds evenly over the animal with a spatula. Fill the hollow center with water; spray seeds and refill center as necessary to keep the seeds moist. Turn animal so both sides are exposed to a well-lighted window, or use a plant lamp. Grease and fumes inhibit growth, so place away from the range. Snip off sprouts near their base with scissors when ready to eat.

Screen frames are useful if you wish to grow quantities of several of the larger sprouts without using up all your kitchen space and containers. You can stack them and rinse seeds easily. Those shown are made of 1 by 2-inch redwood with fiberglass screen stapled to the bottom; redwood and cedar are more resistant to molds than other woods.

Make frames the same dimensions as a shallow kitchen pan (so they can drain into it) but small enough to fit into the sink for rinsing. Between rinses, cover the top frame with a towel to keep seeds warm, moist, and dark. Mung, fenu-greek, and lentil sprouts tend to grow through the screen and wedge tight; when tips first begin to show through screen, turn frame upside down and shake sprouts into another frame.

Regular washing between uses is usually sufficient to clean sprouters, but if mold problems should develop, sterilize by rinsing with a dilute solution of chlorine (1 teaspoon to 1 quart of water) and rinse again with water. □

SUNSET

FEBRUARY, 1979

Cooking with your own sprouts

The leafy green sprouts are best used raw as salad greens or garnishes. Alfalfa sprouts, the mildest of this group, can be used generously; they are often available packaged in produce markets. More peppery chia, cress, mustard, and radish are usually preferred in smaller quantities.

For green salads use $\frac{1}{4}$ to 1 cup chia, cress, mustard, or radish for about a quart torn greens; use from 1 cup to an entire salad of alfalfa.

Inside each meat or cheese sandwich, tuck 2 tablespoons to $\frac{1}{2}$ cup sprouts.

Sprinkle over thick vegetable soups and seafood bisques 1 to 2 tablespoons sprouts per portion; add just before serving.

Sprinkle over cottage or cream cheese about 1 teaspoon sprouts for each serving.

Mix into scrambled eggs just before removing from heat, 1 tablespoon per egg.

The larger white sprouts differ more widely from one another in their uses.

Best known are the sprouts of mung

beans, usually called "bean sprouts." Bland and crisp, they can be used generously either raw or lightly cooked.

If you sprout mung beans at home, you might wish to use them before they reach commercial size—they'll have more legume flavor. Try either size in green salads ($\frac{1}{2}$ to 1 cup for 1 quart torn greens), or use the larger size in meat, seafood, or cheese sandwiches (about $\frac{1}{4}$ cup for each serving).

Fenugreek sprouts, similar to mature mung sprouts in appearance and texture, are slightly bitter. Use them in smaller quantities as a seasoning or with strong-flavored foods that will mask their bitterness. Try fenugreek sprouts sprinkled over cream cheese on crackers, in green salads (2 tablespoons to 1 quart torn greens), stirred into thick vegetable soups (1 tablespoon sprouts per portion; add just before serving), or serve as a bed for curried meat dishes.

Lentil sprouts are similar to immature mung sprouts. Lightly cook them, as in the recipes here. Or try them in a meat loaf (use 2 cups for $1\frac{1}{2}$ pounds meat).

Rye and wheat sprouts are similar in texture and appearance. Use them raw in fruit salads ($\frac{1}{2}$ cup for 2 cups fruit), like mung sprouts in green salads, or lightly cooked as in recipes below.

Both of the grain sprouts can also be added to breads as in recipes that follow; they maintain their chewy, bouncy texture in baking. To serve these breads freshly baked, let cool on racks about 30 minutes; seal inside a plastic bag for 30 minutes more before serving to soften sprouts in outer crust. Or cool thoroughly, then store well-wrapped up to 3 days at room temperature or freeze; sprouts soften while stored.

Sprouted Wheat Bread

- 2 packages active dry yeast
- About 7½ to 8 cups whole wheat flour
- 1 tablespoon salt
- ¼ cup honey
- 3 tablespoons butter or margarine
- 3 cups water
- 2 cups wheat sprouts

In a large bowl of an electric mixer, stir together the yeast, 2½ cups of the flour, and salt. Combine honey, butter, and water in a pan and heat to 120° to 130° (butter does not need to melt). Pour into flour mixture and beat 2 minutes at medium speed. Add another 1½ cups flour and beat 2 minutes at high speed.

Stir in wheat sprouts and enough of the remaining flour (about 3½ cups) to make a stiff dough. Turn out onto a board coated with part of remaining flour and knead, adding more flour as needed, until dough is no longer sticky. Put dough in a large greased bowl; turn over to grease top. Cover and let rise in a warm place until almost doubled, about 45 minutes.

Punch down dough; divide in half and shape into 2 loaves. Place each in a greased 5 by 9-inch loaf pan. Cover and let rise until almost doubled, about 45 minutes. Bake in a 375° oven until browned, about 45 minutes. Turn out of pan and let cool (see paragraph preceding recipe). Makes 2 loaves.—*H. W., San Francisco.*

Sprouted Rye Bread

- About 2¾ cups each regular all-purpose flour (unsifted) and rye flour
- 1 package active dry yeast
- 2 teaspoons salt
- ¼ cup molasses
- 2 tablespoons butter or margarine
- 1½ cups water
- 1½ cups rye sprouts

Blend the all-purpose and rye flours. In a large bowl of an electric mixer, stir together the yeast, 2 cups of the flour mixture, and salt.

In a small pan combine molasses, butter, and water; heat to 120° to 130° (butter does not need to melt). Pour into flour mixture and beat 2 minutes at medium speed, scraping bowl occasionally. Add another 2 cups flour and beat 2 minutes at high speed. Stir in rye sprouts and enough of remaining flour (about ½ cup) to make a soft dough. Turn out onto a board coated with part of remaining flour; knead, adding more flour as needed, until dough is no longer sticky. Put dough in a large greased bowl; turn over to grease top. Cover and let rise

in a warm place until almost doubled, about 45 minutes.

Punch down dough, divide in half, and shape into 2 loaves; place each in a greased 4 by 8½-inch loaf pan. Cover and let rise until almost doubled, about 45 minutes. Bake in a 375° oven until browned, about 40 minutes. Turn out of pans and cool (see paragraph preceding first recipe). Makes 2 loaves.

Brown Rice and Sprout Pilaf

In a saucepan, sauté 1 finely chopped large onion and 1 cup coarsely shredded carrot in 4 tablespoons butter or margarine until soft. Stir in 1 cup regular brown rice; continue to cook, stirring over medium-high heat, until rice begins to slightly brown. Add 2½ cups regular-strength chicken broth. Cover and simmer 45 minutes or until rice is tender and liquid is absorbed. Stir in 2 cups lentil, rye, wheat, or immature mung sprouts (or 4 cups commercial-size mung), and ½ cup minced parsley and remove from heat. Makes 4 to 6 servings.

Vegetable and Sprout Medley

In a wide frying pan, sauté 1 thinly sliced large onion in 2 tablespoons butter or margarine until limp and golden, about 15 minutes; turn out of pan.

Melt another 2 tablespoons butter in the pan. Add 2 cups each sliced zucchini (about ¼ inch thick) and carrots (about ⅛ inch thick), and ¼ cup water. Cover and cook, stirring occasionally, for about 5 minutes or until vegetables are barely tender. Add 1½ cups lentil, rye, wheat, or immature mung sprouts (or 3 cups commercial-size mung), ½ teaspoon salt, and onion, stirring until heated through. Makes 6 servings. □

The Chinese cook bean sprouts in a way that preserves their appealing light color and pleasing crunchiness. They get these good results with the following steam-fry (or stir-steam-fry) method of cooking:

Brown a little meat, poultry, or fish in a small amount of oil. Push meat to one side, add bean sprouts, and stir and toss. Add salt to taste and a little stock or water; cover and steam 3 to 5 minutes. Pour in soy to season, and thicken slightly with cornstarch mixed with a little water. Serve immediately.

If you don't wish to use meat with your bean sprouts, toss and cook them in a little stock. Salt, cover, and steam; add soy and the cornstarch and water thickening, and serve.

Here are two other ways to serve bean sprouts—one is a main dish salad, the other is an egg side dish.

As a luncheon main dish, serve this crunchy salad with a hot biscuit or muffin accompaniment. Little rings of green onion and small bits of carrot add color to the salad.

ORIENTAL LUNCHEON SALAD

- 1 pound bean sprouts
- 1¼ cups steamed rice
- 1 cup thinly sliced celery
- 2 tablespoons chopped green pepper
- 2 small carrots, grated fine
- 3 green onions, sliced (include green tops)
- 2 cups diced cooked chicken or pork
- ½ cup toasted slivered almonds
- Salt and pepper to taste
- ¼ to 1 cup French dressing
- Juice of ½ lemon
- Lettuce
- Soy

Cook bean sprouts in a small amount of salted water just until crisp-tender, 2 to 3 minutes; drain and allow to cool. In a large bowl, combine bean sprouts, rice, celery, green pepper, carrots, onions, chicken, and almonds. Chill thoroughly. Season with salt, pepper, and lemon juice; pour over French dressing, and toss ingredients lightly. Serve in bowls lined with crisp lettuce. You can pass soy sauce for additional seasoning, if desired. Makes 6 to 8 servings.—*F. M., Oakland.*

Since it's similar to egg foo yung, this egg patty would make a good accompaniment for soy fried shrimp or sweet and sour pork.

BEAN SPROUT OMELET

- 6 slices bacon
- 1 cup chopped green pepper
- 1 cup sliced green onions
- 1 package (6 oz.) bean sprouts
- 4 eggs
- 1 teaspoon salt
- ½ teaspoon pepper
- ¼ teaspoon monosodium glutamate
- 2 teaspoons soy

Cook bacon in a 10-inch frying pan until crisp. Remove and drain; keep about 4 tablespoons bacon drippings in the frying pan. Add green pepper, onions, and bean sprouts. Cover and simmer just until vegetables are soft. Beat eggs with salt, pepper, monosodium glutamate, and soy. Add bacon, which has been crumbled. Pour egg mixture over vegetables and cook slowly until firm; loosen bottom of omelet with a spatula. Place a large plate over frying pan, and carefully turn omelet into plate. Slip back into frying pan and lightly brown other side. Serve at once. Serves 4.—*B. L., Alameda, Calif.*

Making yogurt on your own

SUNSET

NOVEMBER, 1964

These coolers use yogurt

Making yogurt is a simple process of inoculating milk with a culture, or starter (a small amount of either commercially made or homemade yogurt), and then holding the milk at the right incubating temperature for a period of hours.

However, making yogurt at home isn't always as easy as this sounds, because of the difficulty of maintaining correct temperature for the time required. Most home cooks are familiar with temperatures required to make bread rise, and can find a cozily warm spot (80°) in their kitchens fairly easily; but yogurt must be held at 20° to 30° higher, and for a longer time. Successful amateurs have found many different ways of managing this.

We tested various home methods during the preparation of this article—including some that directed wrapping the container of milk in two old sweaters or a couple of Turkish towels. Our directions for making yogurt include several suggestions on how you might keep the milk at the right temperature. Your key to success may well depend upon having a good thermometer to eliminate the guesswork.

You can make yogurt from whole or skim milk, or even from rehydrated non-fat dry milk. But to get a product as thick as the commercial yogurt, you will probably need to increase its concentration, especially if you make it from low fat or skim milk. Commercial companies add about 3 per cent extra milk solids when they make yogurt; we just add a little instant non-fat dry milk.

In addition to the recipe for yogurt, we include here directions for making yogurt cheese, similar to cream cheese in texture and flavor.

YOGURT

- 1 quart milk
- ¼ cup instant non-fat dry milk
- 2 tablespoons yogurt (your own or commercially made)

Combine the milk and non-fat dry milk in a heavy pan; bring slowly to the boiling point, stirring. As soon as it boils, remove from heat and cool to about 115° (you can put the pan in a bowl of cold water to speed the cooling). If you don't have a thermometer, put a drop of milk on your wrist; it should feel warmer than lukewarm.

Blend a little of the warm milk with the yogurt until smooth, then stir the yogurt mixture into the warm milk. At this point the object is to maintain the milk at

about 115° for 6 to 8 hours (if it goes below about 95°, the action stops). You can leave the milk in a bowl, if well covered, but it may be easier to handle if transferred to a prewarmed glass jar.

If you have a gas oven, the temperature inside with just the pilot light on may be about right—the temperature must never go over about 120° or your culture will be killed.

Most people simply wrap the container of warm milk in some good insulating material, such as a heavy wool blanket. We have used various insulated boxes and picnic bags successfully, too; you can prewarm them by letting jars of very hot water stand in them while you are preparing the milk. Any of these methods may work, depending on the temperature of the surrounding air.

Be sure to place the insulated container of warm milk in a spot where the rate of cooling will be slow—on a high shelf, in a cupboard above a wall oven (turned on), in the car parked in the sun with windows closed, or near the hot water heater, for example.

During the 6 to 8 hours it usually takes to make yogurt (commercial companies do it in about 4 hours), the milk should not be disturbed. When the yogurt is set, refrigerate it. Makes 1 quart.

You can make yogurt cheese from your own homemade yogurt or from commercially made yogurt. It is a little softer than cream cheese, sweet, and delicious as a topping on fruit. If made from yogurt that has been allowed to stand several days, the cheese develops sharper flavor, similar to the tang of yogurt. Because of its thick consistency, it makes a good base for spreads, salad dressings, and dips. You can season it any way you might season cream cheese.

YOGURT CHEESE

Spoon 1 quart yogurt into a bowl and add about 4 cups cold water; stir until well blended. Pour into a clean cloth bag, such as a muslin dish towel or an old pillow case. Hang the bag over your sink or a bowl and let it drip for 6 to 8 hours, or overnight—the longer it stands, the firmer it becomes. Scrape the cheese from the cloth into a bowl and whip until smooth, adding a few grains of salt, or to taste. Makes about 1½ cups cheese (about 18 calories per tablespoon, if made from skim milk, or 24 if from whole milk).

Cooling beverages based on yogurt are common in the sun-baked countries of the Middle East, and the idea is well worth adapting to Western tastes for our own hot summer days. Adding fruit masks the flavor of yogurt, but its refreshing tartness still permeates.

The basic formula of the yogurt beverages suggested below varies very little and invites further experimentation. You can make the cooling drinks low in calories by thinning with skim milk instead of whole milk, and by using a sugar substitute instead of sugar in those cases where sweetening is required.

It's best to serve the drinks as soon as they are made, or within 3 hours, because flavor and consistency change when they are left standing.

Strawberry Cooler. Whirl 1 cup cold, hulled, sliced strawberries in a blender until smooth with 1 cup cold yogurt and 1 cup skim or whole milk. (Or force strawberries through a food mill or wire strainer and blend with these ingredients.) Add sugar to taste. Makes 3 cups.

Strawberry Fizz Cooler. Follow directions above for strawberry cooler, but use 1 cup cold club soda in place of the milk, and serve at once. Makes 3 cups.

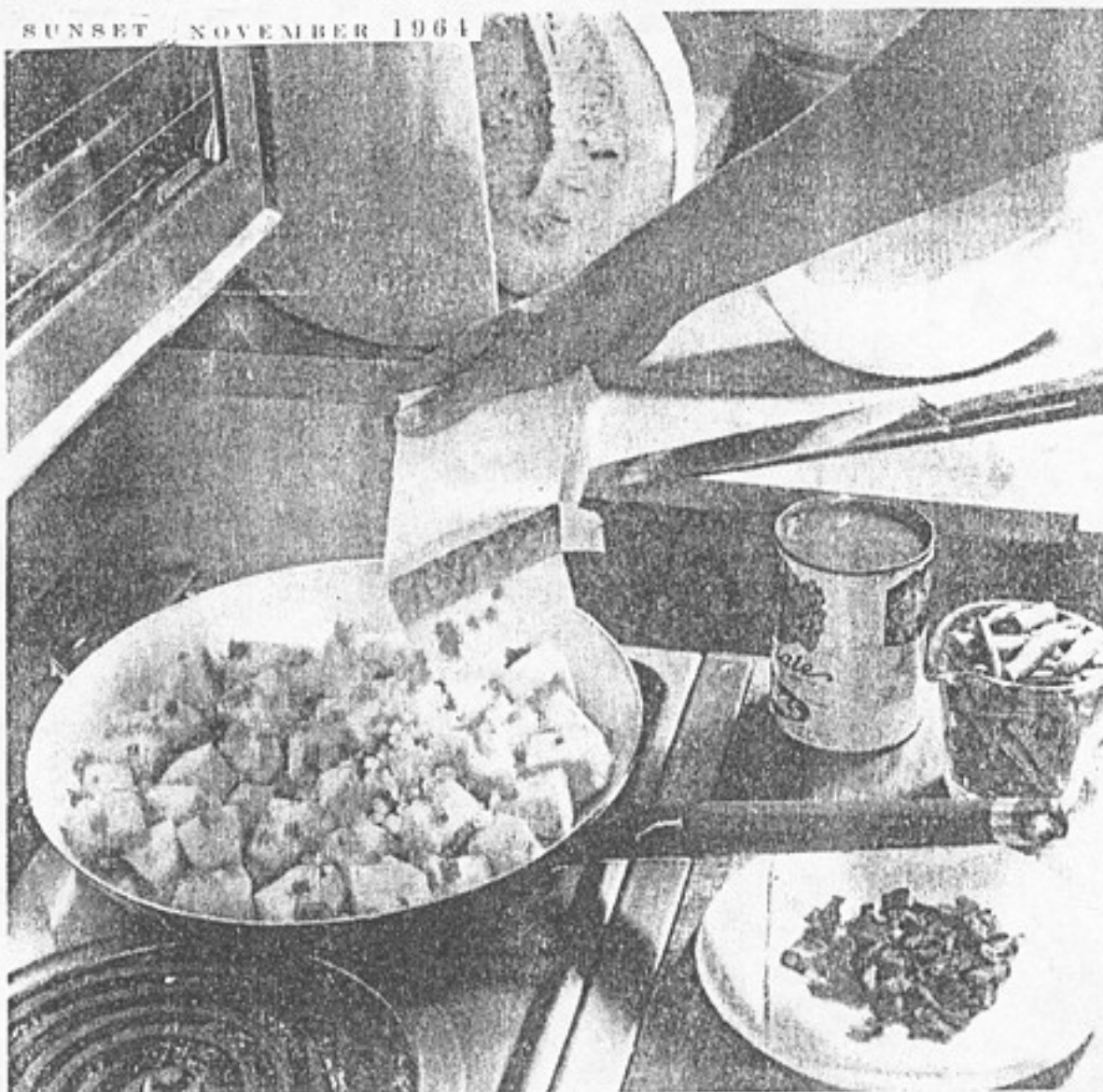
Raspberry Cooler. Force 1 cup cold, slightly crushed raspberries through a food mill or wire strainer, and discard seeds. Blend purée with ¼ teaspoon anise seed (optional), 1 cup cold yogurt, 1 cup skim or whole milk, and sugar to taste. (Or whirl all ingredients in a blender and pour through a wire strainer to remove seeds.) Makes 3 cups.

Blackberry Cooler. Force 1 cup slightly crushed cold blackberries through a wire strainer or food mill, and discard seeds. Blend purée with 1 cup *each* cold yogurt and skim or whole milk, and sugar to taste. (Or whirl all in a blender and pour through a wire strainer to remove seeds.) Makes 3 cups.

Peach Cooler. Peel, pit, and slice enough fully ripe cold peaches to make 1 cup. Whirl in a blender until smooth with 1 cup *each* cold yogurt and whole or skim milk, and sugar to taste. (Or force fruit through food mill or wire strainer, and blend with remaining ingredients.) Makes 3 cups.

Prune Cooler. Blend 1½ cups prune juice with 1½ cups yogurt, ¼ teaspoon cinnamon, and about 1 tablespoon lemon juice (to taste). Makes 3 cups.

SUNSET NOVEMBER 1964



You brown onion, garlic, and green pepper in bacon drippings with cubes of golden pumpkin, then add corn and other vegetables to make colorful Pumpkin Succotash.

Other ways to use pumpkin

The Halloween pumpkins so plentiful now can be cooked as well as carved. When you shop for a jack-o'-lantern pumpkin, consider getting a second and preparing it as a vegetable or relish, including it in a soup, or using it for a pie.

Most pumpkins are large enough to be used in several dishes. In general, pumpkin may be substituted for squash in recipes. Pumpkin tends to have more flavor than squash, although it is somewhat more watery and granular.

To make the puréed pumpkin of a consistency similar to that of the canned product, cut the pumpkin in half, remove the seeds and stringy interior, and cut the pumpkin into smaller pieces that are easier to handle. Peel the pieces, bake, steam or boil them until tender, and finally, put the cooked pumpkin through a food mill or whirl it in a blender. Three pounds of raw pumpkin will yield about three cups of the purée.

A smooth golden pumpkin soup is a good way to start a meal. You can garnish this

delicately flavored bisque simply by sprinkling it with paprika, or elaborately by floating sour cream and snipped parsley in each serving.

PUMPKIN BISQUE

- 4 cups peeled, seeded pumpkin, cut in 1-inch cubes
- boiling water
- 1 cup chopped onion
- 2 cup finely chopped celery
- 1 bay leaf
- 3 whole cloves
- 1 cup half-and-half (half milk and half cream)
- 1 tablespoon cornstarch
- 1 can (14 oz.) chicken broth
- 1 teaspoon salt
- Dash white pepper
- 2 tablespoons dry Sherry
- Paprika

Cover pumpkin with boiling water, bring to a boil and cook 15 to 20 minutes or until the pumpkin is very tender. Drain, reserving liquid, and whirl pumpkin in a blender or put through a food mill. You should have about 2 cups of pumpkin purée. Add water to liquid in which pumpkin was cooked to make 2 cups;

then add onion, celery, bay leaf, and cloves. Boil until liquid is reduced to 1 cup, strain, and add to pumpkin purée in 2-quart pan. Blend half-and-half with cornstarch; add chicken broth and half-and-half mixture to pumpkin mixture. Heat slowly to boiling point, stirring frequently. Add salt and pepper; just before serving, add Sherry. Serve sprinkled with paprika. Makes 6 cups, 6 to 8 servings.—*E. L., Salem, Ore.*

Pumpkin chips are an unusual relish for an autumn meal. Lemon slices give a piquant flavor.

PUMPKIN CHIPS

Peel, seed and thinly slice pumpkin to make 4 cups. In large bowl place a layer of pumpkin. Measure 2 cups sugar and sprinkle pumpkin with about a third of it. Thinly slice 2 whole lemons, and cover sugar with about a third of the slices. Repeat layering, using remaining sliced pumpkin, sugar and lemon slices, until all are used. Let stand overnight.

The next day, cook the pumpkin mixture until the pumpkin slices are clear, about 30 minutes. Stir in $\frac{1}{2}$ teaspoon vanilla and serve warm or cold. Makes about 2 cups relish.—*I. B., Portland.*

The brilliance of pumpkin is brought out by turmeric, one of the condiments that seasons Coconut Chicken with Pumpkin. Coconut milk subtly flavors the sauce.

COCONUT CHICKEN WITH PUMPKIN

- 1 large broiler-fryer, cut up
- Flour, salt, and pepper
- $\frac{1}{4}$ cup butter or margarine
- $\frac{1}{2}$ cup chopped onion
- 1 clove garlic, mashed
- 2 teaspoons salt
- $\frac{1}{4}$ teaspoon ground ginger
- $\frac{1}{2}$ teaspoon turmeric
- 4 whole cloves
- 1 cup thawed frozen coconut milk (see note)
- $\frac{1}{2}$ stick cinnamon, chopped
- 6 cups peeled, seeded pumpkin, cut in $1\frac{1}{2}$ -inch cubes

Coat chicken with seasoned flour. Heat butter in large saucepan or Dutch oven; brown the floured chicken pieces on both sides in heated butter. Remove chicken and keep warm. To the butter remaining in the pan add onion, garlic, salt, ginger, turmeric, and cloves; cook until onions are soft and slightly browned. Return the chicken to the pan. Stir in the coconut milk (see note), place pieces of stick cinnamon on chicken, and cover pan. Simmer slowly about 10 minutes. Blend pumpkin cubes into sauce with chicken and cover again; continue cooking 25 to 30 minutes longer or until pumpkin is

tender. Serve chicken and pumpkin on platter; strain sauce and serve separately, if desired, with rice. Makes 4 to 5 servings.—J.S., Los Angeles.

Note: If frozen coconut milk is not available you can prepare the milk from fresh coconut: Finely shred the meat of a fresh coconut and place it in a pan that has a tight cover. Cover the coconut with boiling water, cover pan, and let steep about 15 minutes. Pour the coconut through a fine wire strainer, reserving the liquid. Canned coconut may be used in the same way, but if it is sweetened, the coconut milk, and consequently the chicken, will be sweeter.

A variety of vegetables blends flavors in this colorful skillet dish. Serve it in individual bowls with crisp bacon bits topping each serving.

PUMPKIN SUCCOTASH

- 4 slices bacon, chopped
- ½ cup chopped onion
- 1 clove garlic, finely chopped
- 1 green pepper, seeded and finely chopped
- 3 cups peeled, seeded pumpkin, cut in ¾-inch cubes
- 1 can (1 lb.) tomatoes
- 1 cup uncooked, sliced green beans
- 1 package (10 oz.) frozen whole kernel corn, thawed
- 2 teaspoons salt
- Dash pepper

Fry bacon until it is crisp; drain and reserve. Measure the drippings and return ¼ cup to the frying pan. Add onion, garlic, green pepper, and pumpkin; cook, stirring occasionally, for 5 minutes. Stir in tomatoes, beans, corn, and seasonings. Cover and simmer until pumpkin is tender, about 25 minutes. Serve topped with bacon. Makes 6 to 8 servings.—I.R., North Sacramento, Calif.

Pumpkin invariably suggests pie, but not necessarily one like this. It is made with sliced, steamed pumpkin instead of the usual purée. It further departs from tradition in that it is topped with a nut streusel mixture.

SLICED PUMPKIN PIE

- 8 cups peeled pumpkin slices, ¼ inch thick
- 2 tablespoons quick-cooking tapioca
- 9-inch unbaked pastry shell
- 1 cup brown sugar, firmly packed
- 1 tablespoon grated orange peel
- ½ teaspoon salt
- 1 teaspoon cinnamon
- ¼ teaspoon nutmeg
- ⅓ teaspoon ground ginger
- Brown Sugar Streusel (see below)

Steam the pumpkin until tender but firm, 10 to 15 minutes; then drain. Sprinkle 1 tablespoon of the tapioca into the pastry shell. Top with half the pumpkin and remaining tapioca. Combine sugar, orange peel, salt and spices; sprinkle half of the mixture over pumpkin in the pastry shell. Top with remaining pumpkin and sugar mixture. Cover with Brown Sugar Streusel. Bake in a hot oven (400°) for 40 minutes or until crust and topping are nicely browned. Makes 1 9-inch pie.

Brown Sugar Streusel: Blend together ¾ cup unsifted flour and ½ cup firmly packed brown sugar. Cut in ¼ cup soft butter or margarine until crumbly. Blend in ½ cup chopped walnuts.

Pumpkin Parfait. Blend together in the top of a double boiler 1 can (1 lb.) pumpkin, ½ cup firmly packed brown sugar, 3 egg yolks, 1 cup commercial sour cream, 1 teaspoon cinnamon, ½ teaspoon ground ginger, and ¼ teaspoon each cloves, nutmeg, and salt. Cook over hot, not boiling water, for about 10 minutes; stir frequently. Remove from heat. Beat 3 egg whites until stiff; gradually add ½ cup firmly packed brown sugar and beat until

whites hold soft glossy peaks. Fold into pumpkin mixture. Chill.

Whip 1 cup heavy cream until stiff. Sweeten with 2 tablespoons sugar and flavor with 1 tablespoon rum (or ¼ teaspoon rum flavoring). Fold in ½ cup crushed nut brittle. Alternate layers of pumpkin and whipped cream mixtures in parfait glasses, top each with a nut meat. Chill, covered (as long as overnight), before serving. Makes 6 to 8 servings.—H.M., Los Angeles.



Toasted pumpkin seeds

The next time you make a Jack-o'-lantern or use fresh pumpkin in a recipe, save the seeds to roast. It's such a simple process that even small children can do it. Some people eat the entire seed; others discard the outer shell and eat only the center portion.

Toasted Pumpkin Seeds. Wash fibers from pumpkin seeds; drain off excess water. Sprinkle a solid layer of salt in the bottom of a cookie pan or other shallow baking pan. Arrange seeds in a single layer on the salt. Place in a moderately slow oven (300°) for 45 to 50 minutes, or until seeds are lightly browned. Cool in the pan. One medium-sized pumpkin yields about 1 pint seeds.—J.G., San Mateo, Calif.

The Italian way with polenta

SUNSET MARCH, 1953

Coarsely ground cornmeal, simmered to a mush called *polenta*, takes the place of *pasta* in those parts of Italy which grow no wheat. We recommend it to Western cooks for menu variety.

The Italians usually smother polenta with thick gravies and fowl, meat, or cheese. Try combining it with: rabbit and green olive sauce, chicken and mushroom gravy, rabbit or quail stew, anchovy gravy and fried tomatoes, pork chops and brown gravy, or the usual spaghetti sauce.

Italian-born Mrs. Felicita Cara of San Francisco serves polenta with chicken livers for a favorite family dish. She cooks 3 cups (1 lb.) cornmeal in 6 cups water and 2 teaspoons salt for 20 minutes, using a wooden spoon or sawed-off broom handle to stir. Then she makes the sauce.

CHICKEN LIVER SAUCE FOR POLENTA

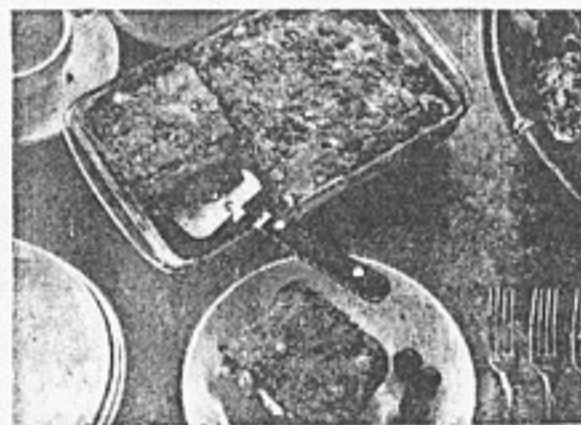
- 1 cube (½ cup) butter or margarine
- 3 slices bacon, diced
- 10 chicken livers, cut in half
- ¼ teaspoon crumbled, dried sage leaves
- Salt and pepper to taste
- 1½ cups stock or bouillon

Melt butter in a saucepan and stir in bacon, chicken livers, sage, salt, and pepper. Cook until browned. Pour on stock and simmer 10 minutes. Spoon over polenta. Serves 6.

For a stiff polenta, turn the pot upside down and slam it on a wooden board covered with a napkin. This makes the polenta fall out like a cake. The experts cut it with a taut string into 1-inch wide slices for individual servings.

Trimming polenta

The trimmings for pizza are equally good on polenta—thick cornmeal mush which is often served as a substitute for *pasta* (see *The Italian way with polenta*, in the March 1953 *Sunset*). Start by cooking $1\frac{1}{2}$ cups coarsely ground cornmeal for 30 minutes in 6 cups water seasoned with 1 teaspoon salt and 1 bouillon cube; stir often. Meanwhile, simmer together 1 small can each tomato sauce and chopped ripe olives. Season with $\frac{1}{2}$ teaspoon each basil, oregano, and sugar; 1 tablespoon each chopped parsley and olive oil; and with pepper and garlic salt to taste.



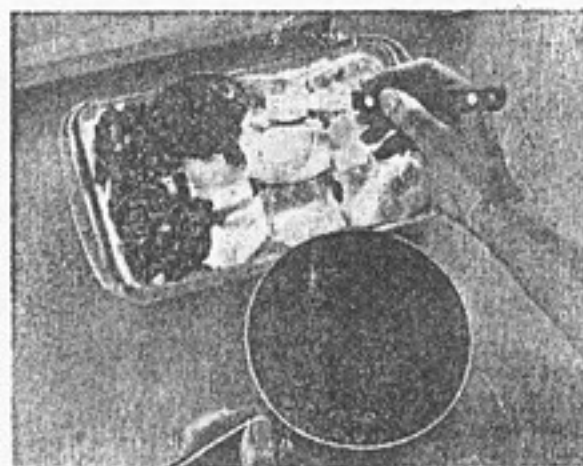
A hearty fall supper dish: polenta baked with spicy sauce and cheese. Cut into squares; serve with a tossed green salad



This heavy copper polenta pot is designed with a wider top than bottom to give leverage when cornmeal is stirred with stick

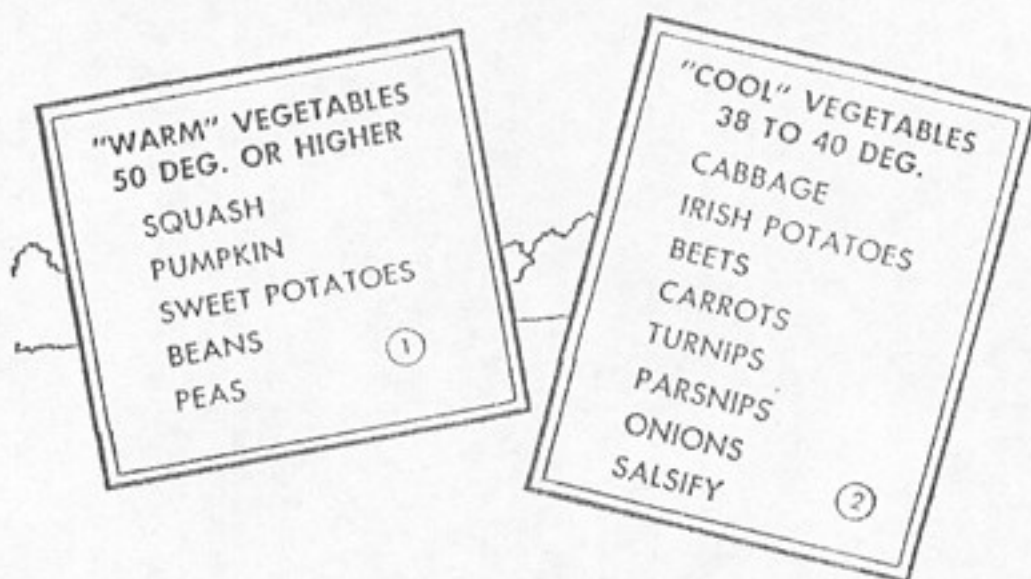


Spread 1 inch of polenta over a well oiled baking dish. Then cover polenta with $\frac{1}{2}$ pound sliced soft Monterey Jack cheese



Spoon tomato sauce over cheese slices; sprinkle with $\frac{1}{2}$ cup grated Parmesan cheese; bake in 300° oven for 30 minutes

VEGETABLE STORAGE



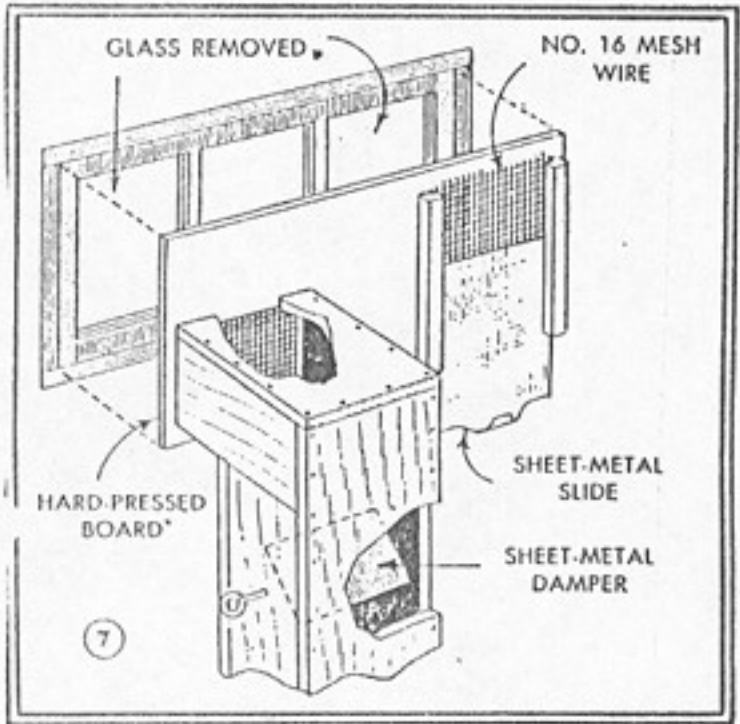
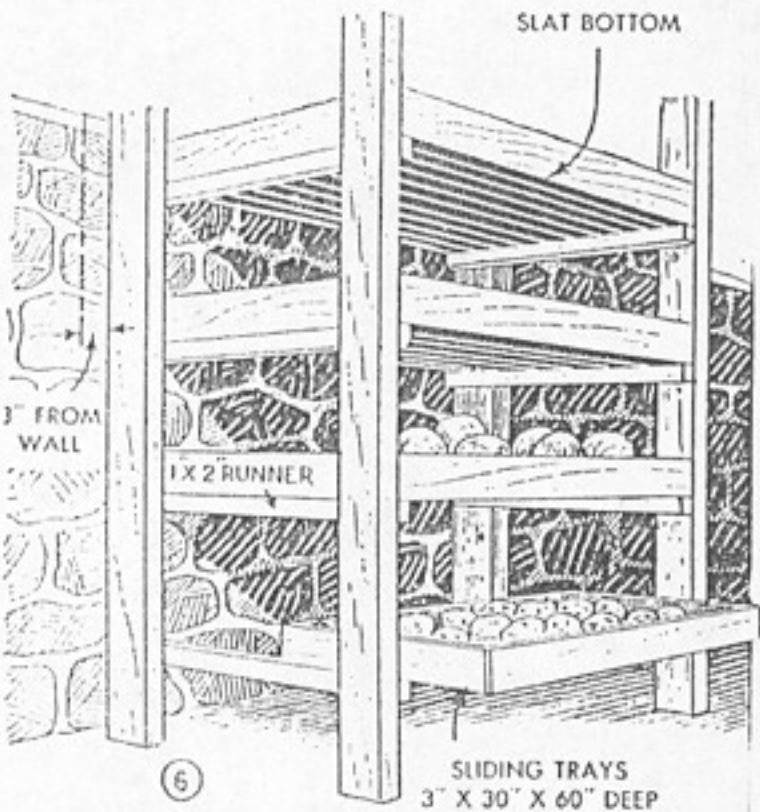
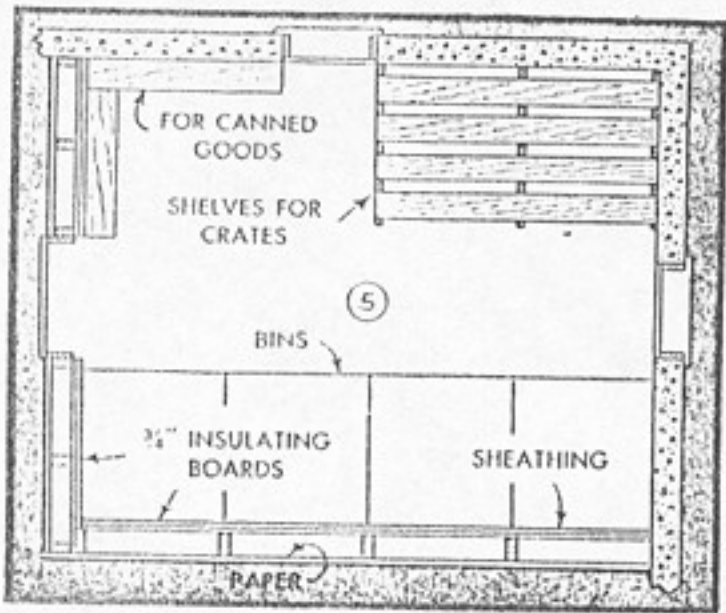
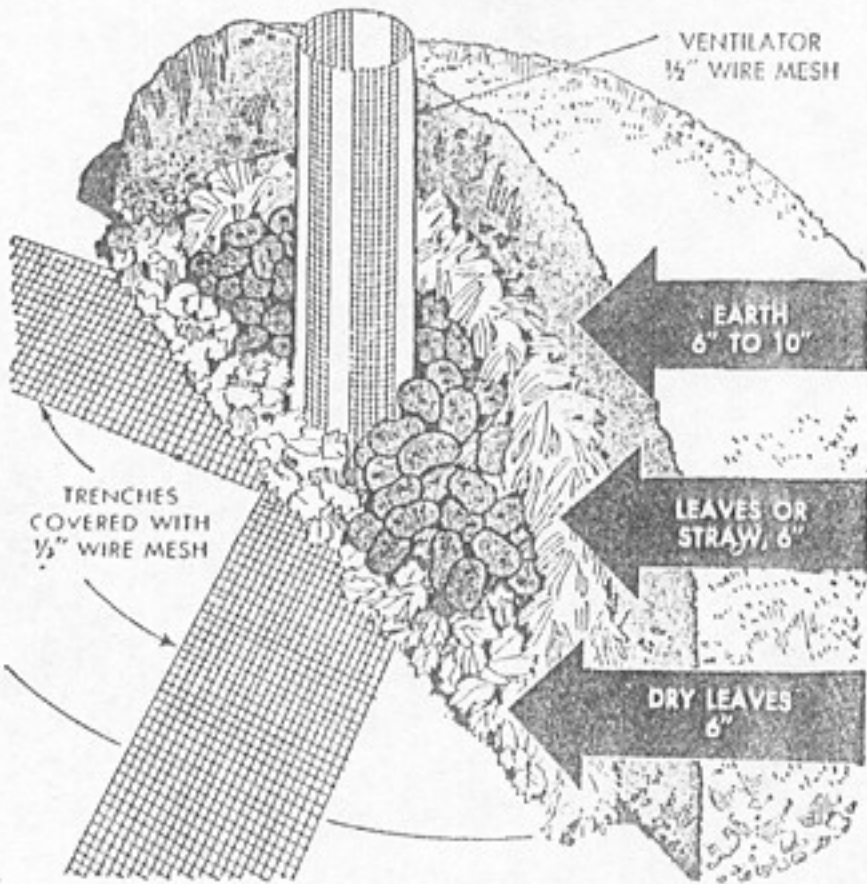
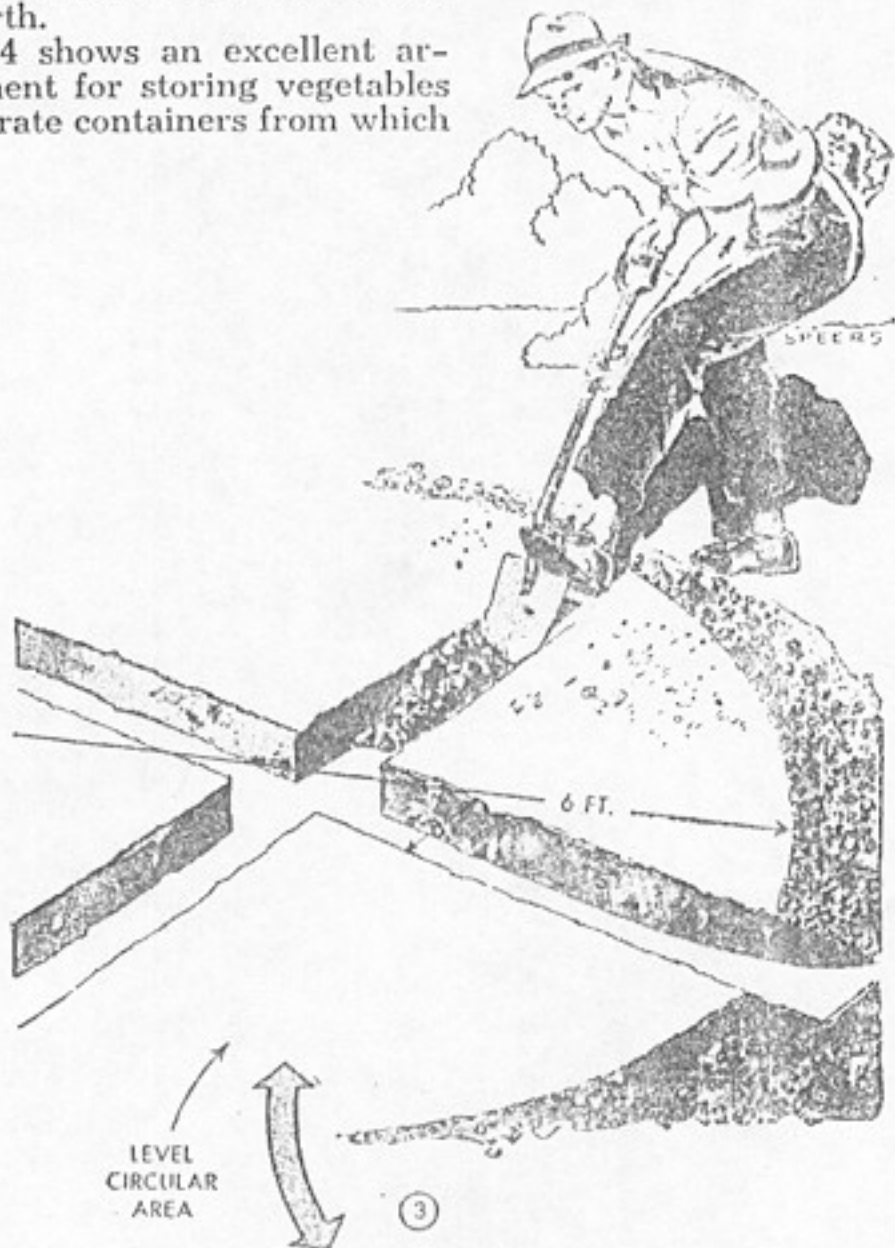
WHEN storing vegetables there are three essentials to safe keeping: quality, temperature and humidity. None but sound vegetables of first quality should be selected for storing. Figs. 1 and 2 list the principal

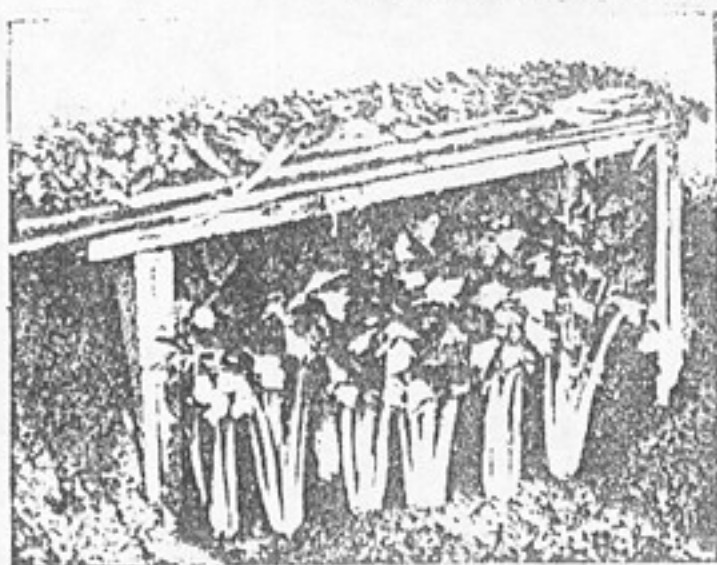
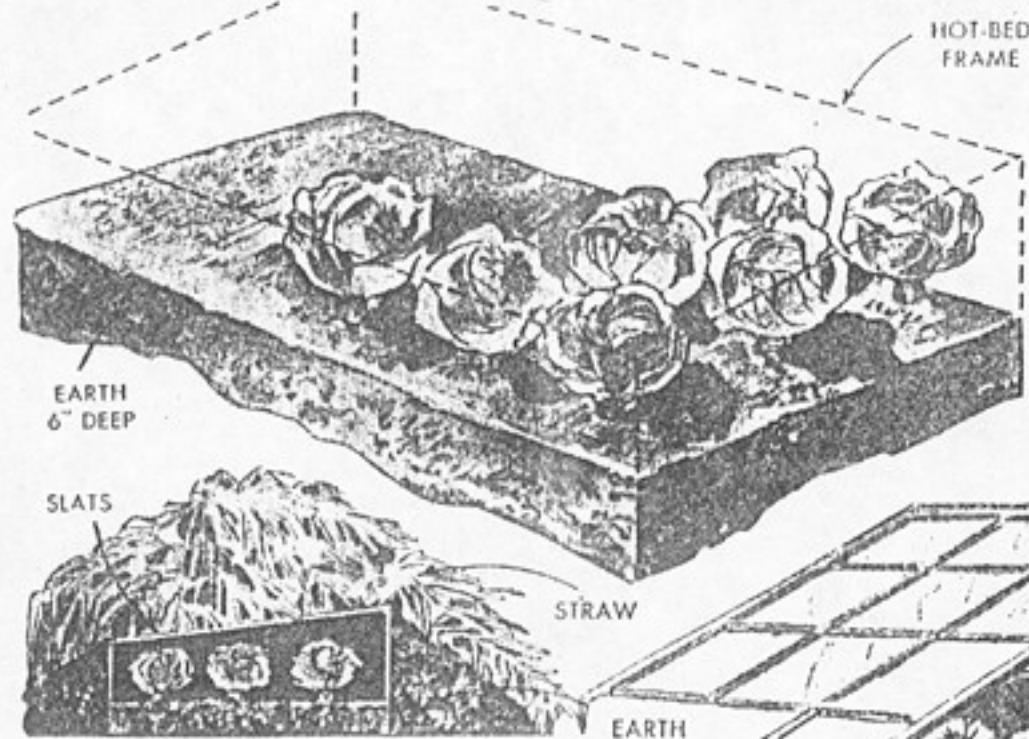
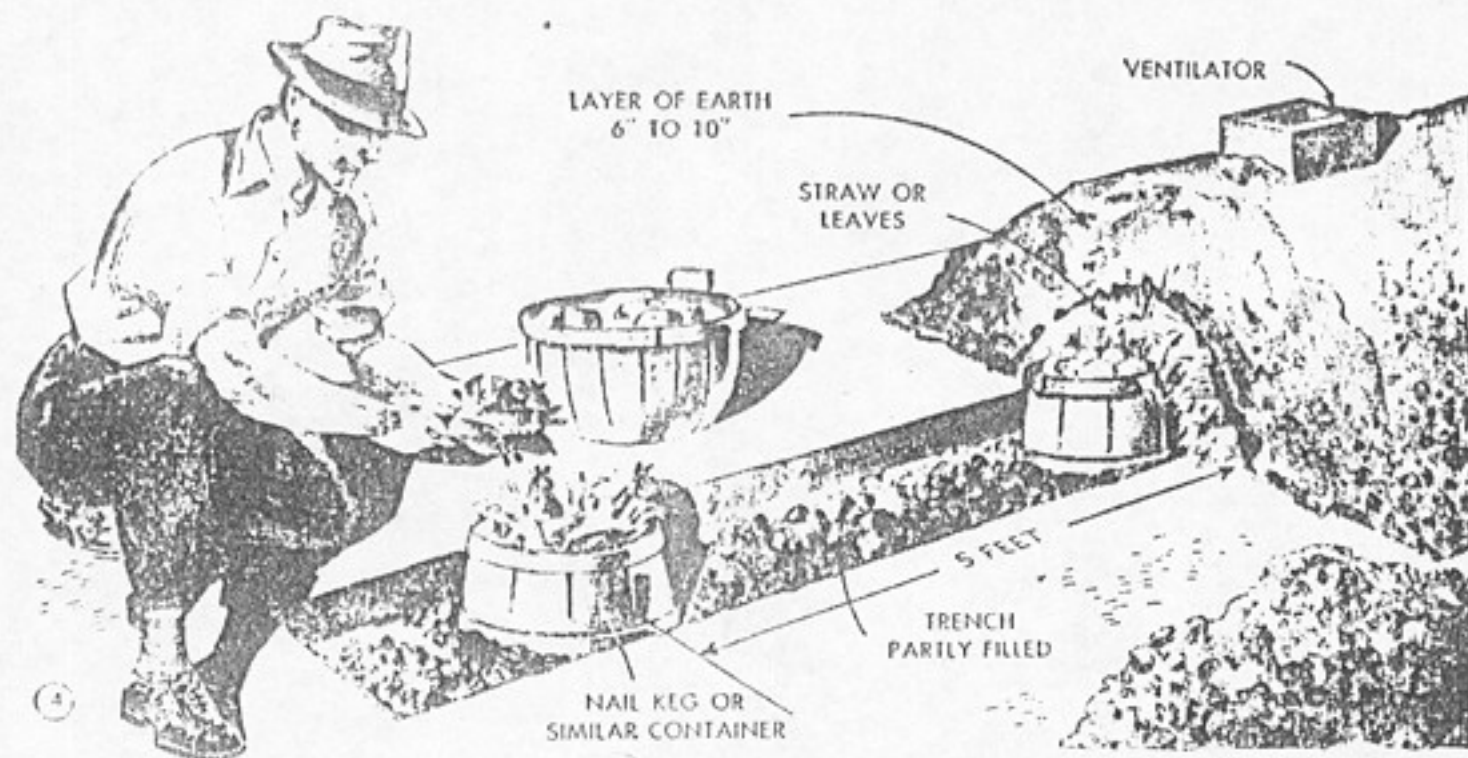
"warm" and "cool" vegetables. Those in Fig. 2 keep best when stored at a temperature of 38 to 40 degrees F. and under conditions of relatively high humidity. Temperature is controlled more easily than humidity. It is difficult to

maintain the proper temperature and humidity in the average home basement for "cool" vegetables while "warm" varieties will generally keep very well under these conditions. One good plan for storing the "cool" vegetables, particularly the root crops, potatoes, beets, carrots, and so on, is in an outdoor mound made as shown in Fig. 3. Select a high spot from which there is good drainage, level a circular area and dig cross trenches as shown. Cover these with wire if available, or with wooden slats. A wire or wooden ventilator should also be provided. A wooden one is made square, from 1 by 6-in. stock and a series of $\frac{1}{2}$ -in. holes are bored through each side. Place the vegetables on leaves or straw in a conical pile not more than 30 in. high. Cover as indicated, but leave the ends of the trenches open until lower temperatures during winter make it

necessary to close them with straw and earth.

Fig. 4 shows an excellent arrangement for storing vegetables in separate containers from which

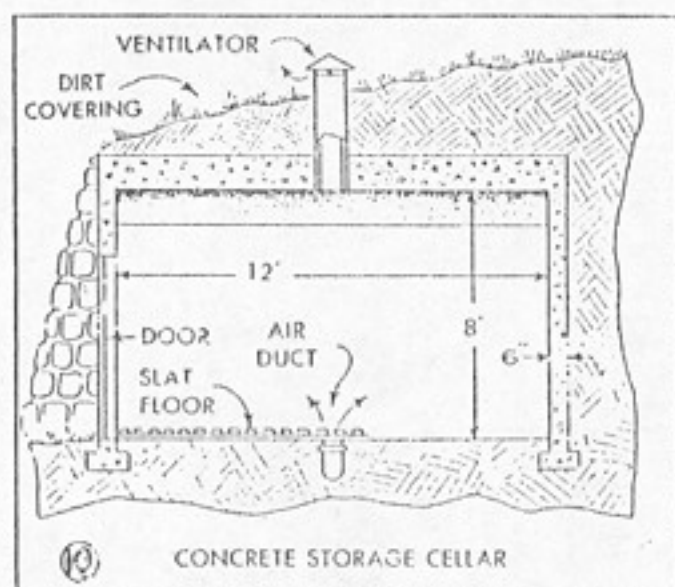




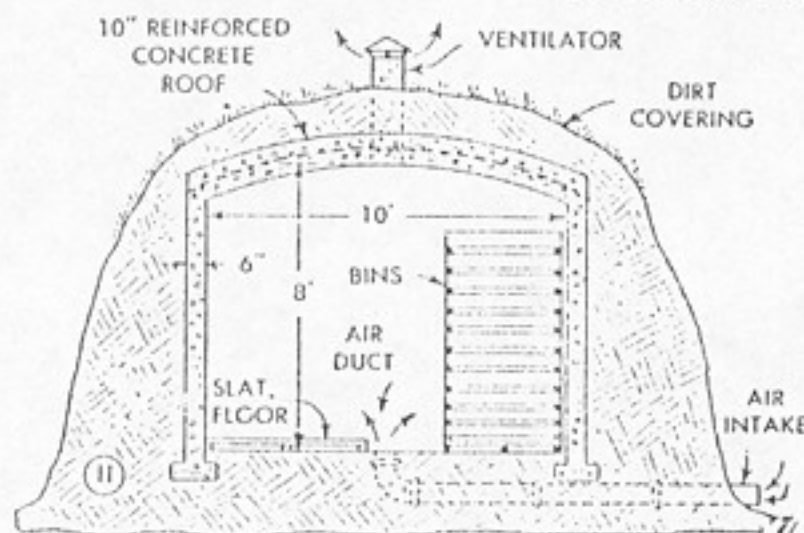
9 CELERY STORED IN HOTBED

a quantity can be removed as needed without disturbing the rest. The details are self-explanatory. Any number of containers can be used. If suitable kegs are

not available, bushel baskets will serve. If sand is obtainable, use it to fill the trench. Similar arrangements are shown in Figs. 8 and 9 and 12 and 13. Figs. 8 and 9 show use of a hotbed for storage of cabbage and celery. In each instance remove the original soil and compost or manure bottom from the hotbed. The cabbage heads are pulled roots and all and "planted" in fresh soil as indicated. Only the roots need be buried. Then, cover as indicated. Celery, Fig. 9, may be kept in the same way. In Figs. 12 and 13 the vegetables are stored in



a barrel placed in a shallow pit which has been partly filled with sand. The end of the barrel is only partly closed as indicated. When an opening is left in the earth covering in the earlier months no vent is needed. Now, there are several pointers in connection with this type of storage: Storing in large piles always should be avoided as sweating is likely to occur, resulting in heating and decay. Irish potatoes and beets are particularly susceptible. As added precaution in any form of mound storage, dig a shallow drainage ditch around the mound. Tops of the ventilators should always be covered to prevent entrance of rain and snow. The next best thing to the mound storage of small quantities of cool vegetables is a basement storage room built in a corner as detailed in the plan view Fig. 5. Dimensions can be whatever is desirable, but 10 by 12 ft. is a good average. When the floor is concrete you have the problem of humidity, but this can be at least partially solved by waterproofing the "sills" of the two walls and covering the floor with a half and half mixture of sand and peat moss to a depth of about two inches. This should be kept damp at all times. Walls should be tight clear to the sub floor to exclude dry air and heat from the furnace room. Paint all window glass black or cover with black paper to exclude light. Fit a ventilator over one window as in Fig. 7. The intake duct, the lower one, exhausts air at a point about 10 in. above the floor and is fitted with a swinging damper. If sheet metal is not available for these parts use box boards or wall board. Both inlet and outlet should be covered either with wire or closely spaced slats. With this arrangement it is possible to control both temperature and humidity with a fair degree of accuracy. A handy bin arrangement is shown in Fig. 6. The sliding trays make cleaning easy and during the summer they can be removed and stacked



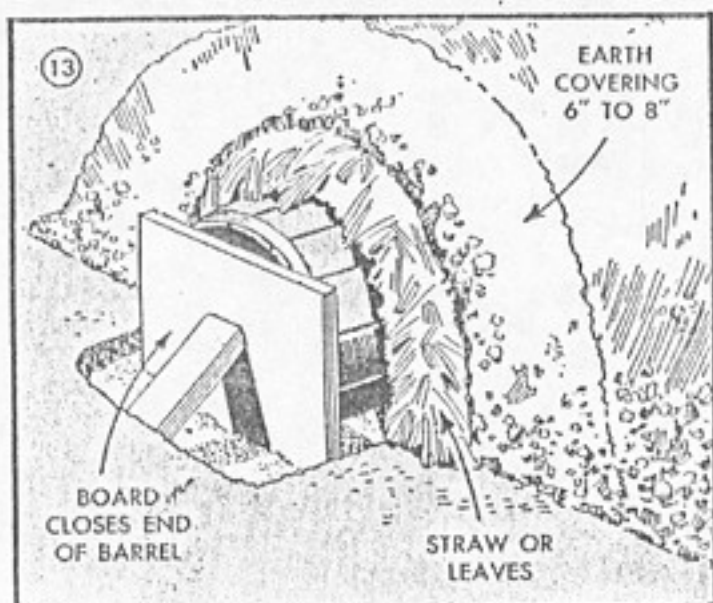
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and the space used for other purposes.

Figs. 10 and 11 detail a more pretentious structure of a permanent type to be built into a hillside or on high ground from which there is drainage in all directions. Walls, roof, and ends are of reinforced concrete but the floor is of earth. This type of structure results in good storage conditions for vegetables, particularly root crops. It is always better to store the cool vegetables in shallow bins with slat bottoms than in baskets or barrels. However, where either of the latter must be used, the wooden barrel is usually best. A number of $\frac{3}{4}$ -in. holes bored through the barrel staves near

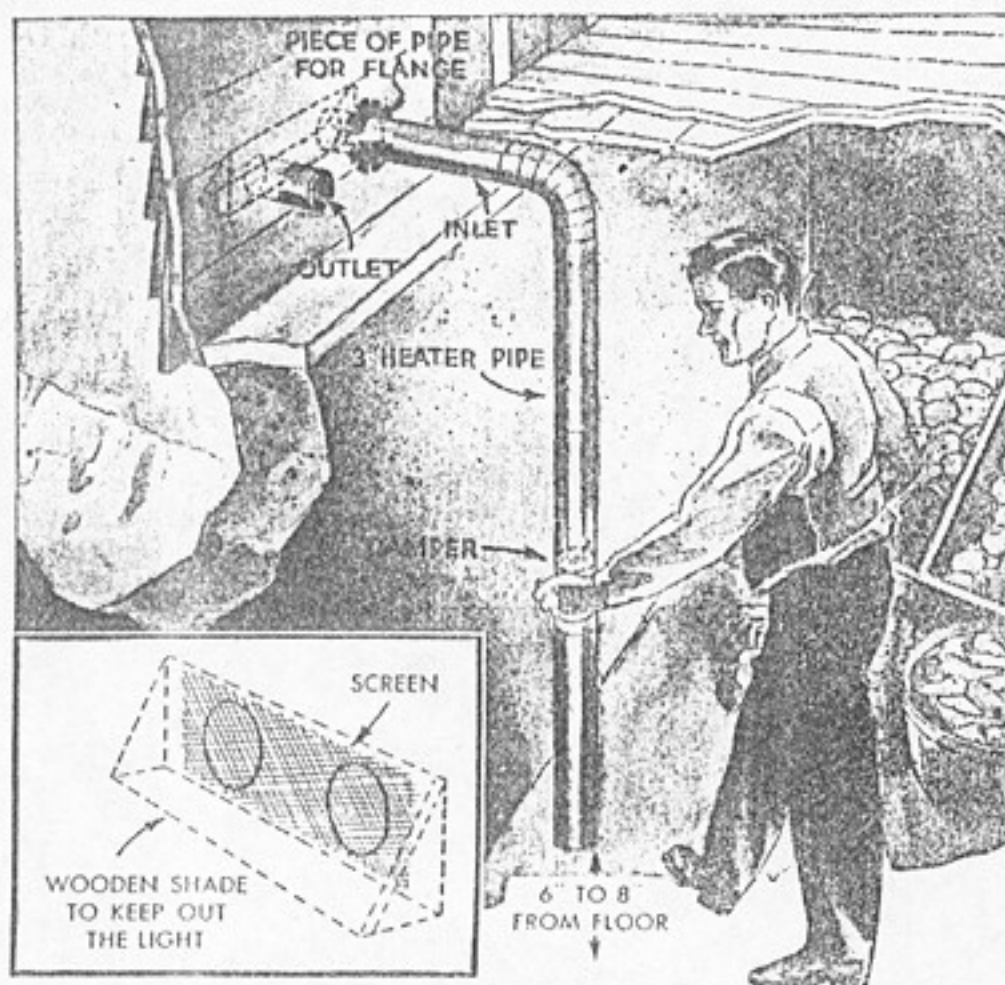
the bottom will aid air circulation. Pumpkins and squashes usually will keep well in a dry, well ventilated basement, or anywhere in the house where there is no danger of freezing. They should not be piled



but rather placed in rows on a shelf. The attic floor is generally a good place to keep peas and beans, after curing on the vine. Pick pole beans as soon as they are mature and spread the pods to dry on the floor. Bush beans are generally allowed to mature on the vine, then the whole plant is pulled and allowed to cure much like hay. After thorough curing the beans are thrashed out and stored in bags hung in a dry place. Sweet potatoes can be kept fairly well in a mound, but a warm, dry place is preferable. In all the methods of mound storage detailed it should be remembered that where the temperature is likely to fall to zero F. or below, the covering of earth and straw will need to be built up to a somewhat greater thickness than that indicated, perhaps a foot or more in the colder climates. If loose earth tends to wash off the mound, cover it with roll roofing or sisal paper.

Winter Air Refrigerates Vegetable Storage Room

Safe storage of vegetables in a basement requires that the storage room be kept as cool as possible, and that proper ventilation and humidity be maintained. To approximate this condition in the average home, the owner can bring cool air in from the outside by means of a 3-in. sheet-metal heater pipe as shown. The pipe should extend down to within 6 to 8 in. of the floor, and a short outlet pipe should be provided as indicated to permit air circulation. A damper in the inlet pipe permits regulation of the incoming air to prevent freezing inside the storage room during extremely cold weather. As the storage room should be dark inside, a shade is fitted over the ends of the pipes where they pass through the outside wall. This is merely a triangular box having the underside open. Screen wire over the ends of the pipes keeps out insects. Of course, the storage room should be tight to



keep cold air from entering the rest of the basement. If possible, the room should be insulated. This can be done inexpensively by lining it with ½-in. insulating board, which is available at your lumber yard.

SUNSET

JUNE 1974

Jars of delicious home-dried fruits—apples, apricots, peaches, pears, figs, nectarines, raisins, prunes—are ready to eat or to store for a variety of later uses

The ancient art of fruit drying

Today you use the sun, sulfur, or the heat of your oven

Sun-drying is probably the oldest method of preserving fruit. When exposed to the sun and wind, fruits just naturally shrivel and dry. And when most of the moisture is gone, spoilage is delayed and the fruit may be stored.

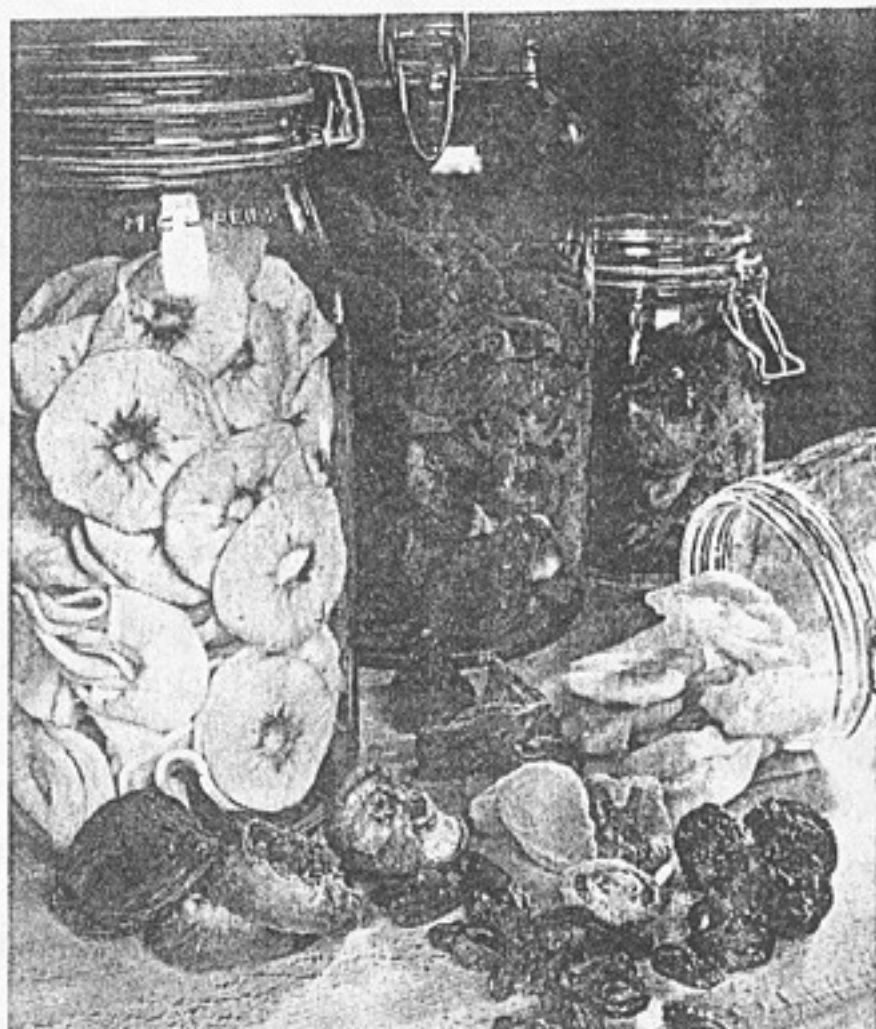
Nature's simple process is essentially the way fruit drying is still done. Clusters of table grapes laid out in the sun turn into raisins. Fully ripe figs and prunes need little more than direct exposure to sun and air to dry.

But, of course, fruits like apples, pears,

apricots, and peaches turn brown when exposed to air. This chemical reaction, called oxidation, also robs the fruit of flavor and vitamin C.

In order to dry these light fruits so they

taste and look as good as dried fruits you can buy, you must halt the oxidation process. The most effective treatment known today is to expose the cut fruit to the fumes of burning sulfur. The



FRUIT	VARIETIES BEST FOR DRYING	HOW TO PREPARE THE FRUIT	TREATMENT BEFORE DRYING	TEST FOR DRYNESS
Apples	Firm varieties such as Gravenstein, Newtown Pippin, Winesap, Rome Beauty, and Jonathan	Peel, cut off both ends. Either cut out core and slice apples into 1/4-inch-thick rings, or cut into 1/4-inch-thick slices, removing core.	Sulfuring is preferred. Use 2 teaspoons sulfur for every pound of cut fruit.	Soft, leathery, pliable.
Apricots	Blenheim, Royal, and Tilton	Wash, cut in half, remove pits.	Sulfuring is preferred. Use 1 teaspoon per pound of cut fruit.	Soft, pliable—slightly moist in center when cut in half.
Figs	Adriatic, Calimyrna, Mission, and Kadota	Leave figs on tree; when fully ripe, and ready for drying, they fall to the ground. Wash, leave whole.	No treatment necessary.	Leathery outside but still pliable. Interior should be a little sticky but not wet.
Grapes	Thompson Seedless and Muscat	Wash, leave whole. Leave stems on until after fruit is dried.	No treatment necessary.	Raisinlike texture, wrinkled.
Nectarines and peaches	Freestone varieties	Wash, cut in half, remove pits. Not necessary to peel peaches but will result in better-looking dried fruit.	Sulfuring is preferred. Use 2 teaspoons sulfur for every pound of cut fruit.	Soft, pliable—slightly moist in center when cut in half.
Pears	Bartlett	Wash, peel, cut in half, remove core.	Sulfuring is preferred. Use 2 1/2 teaspoons sulfur for every pound of cut fruit.	Soft, pliable—slightly moist in center when cut in half.
Prunes	French, Imperial, Sugar, Standard, Burton, and Robe de Sergeant	Halves: Wash, cut in half, remove pits. Whole: Check or crack skins in lye bath as directed on page 151.	No treatment necessary.	Halves: Flesh firm but still pliable. Whole: Flesh firm—pit will not slip when prune is squeezed.

sulfur prevents browning and also helps repel insects, speeds up drying time, and acts as a preservative. The drying process can be stopped while the fruit is still pliable, retaining most of its original shape, color, and vitamin C.

Sulfuring is the technique commercial fruit dryers use and it's recommended for home fruit drying. Food technologists at the University of California at

Davis have assured us that when this technique is properly used, it is perfectly safe and leaves no harmful residue on the fruit. Directions for sulfuring fruits at home are given on page 151. The chart below tells which fruits require it and the amount of sulfur to use.

The alternatives to sulfuring are all far less effective. Blanching fruit in steam before drying helps destroy the enzymes that promote oxidation; dipping fruit in antioxidants like ascorbic acid (vitamin C) or salt helps retard darkening, but the fruits become soft and are hard to handle.

Our chart on page 148 gives the information you'll need to produce delicious home-dried fruits. Some varieties give better results than others. Large-sized fruits need to be sliced or cut. Prunes have tough skins; before you dry them whole they need to be dipped in a weak lye solution so tiny cracks form in the skin. (Directions follow; it's safe when done as directed.) Or you can halve the prunes and eliminate this step.

Select fully ripe but not mushy fruit—fruit that is in top condition for eating fresh. Under-ripe prunes, for instance, will turn dark brown and get puffy.

Sort and wash all fruit. Discard any that shows signs of spoilage, unless it can be completely cut away.

For figs, grapes, and prunes

Line drying trays with a double layer of cheesecloth (available by the yard in fabric stores). The trays can be rimmed baking sheets, clean shallow cardboard or wooden boxes, or stackable wooden trays made of fruit packing lugs (see page 153). Spread fruit slightly apart on cheesecloth.

Arrange trays in the sun, off the ground on benches or a picnic table if possible. To protect from insects, cover trays with a single layer of cheesecloth so cloth doesn't touch fruit. Check frequently; move trays when shaded.

If you live in an area where nights are relatively clear and nighttime temperature doesn't drop more than about 20°

below midday highs, you can leave trays outdoors or stack them and cover. If there's fog or the temperature is expected to drop more than 20°, bring trays under cover or indoors.

If it rains, bring trays indoors, and if they need to remain indoors more than just briefly, cover with cheesecloth to protect from dust. The fruit will continue to dry, but much more slowly. Check frequently, and if you see any mold forming, do this: Mix 1 tablespoon

sodium hypochlorite (available in drug stores) and 1 quart water. Moisten a cloth with solution and wipe off mold. The solution will slow down, but not prevent, additional mold from forming.

The time it takes to dry fruit depends on its size and on the temperature and humidity. In hot areas, it may be done in two or three days; in cooler areas up to about seven days. Test for dryness, using guidelines in the chart on page 148. When dry, bring indoors and let fruit cool completely before packaging.

Store dried fruit sealed inside double plastic bags, in glass jars, or in plastic or ceramic containers (rinse containers in hottest tap water and dry well). Metal containers may be used if you package fruit in plastic bags first. Place a double layer of clear plastic film over mouth of a jar before putting on a metal lid.

Let fruit mellow for about two weeks before eating. Packaged fruit stored in a cool dry place, or refrigerator or freezer, should keep for about a year. Remember to check fruit often; discard any that turn moldy.

If the fruit is firmer than you like, "tenderize" it before eating by immersing in boiling water for about 15 seconds, then let dry on paper towels.

Lye bath for whole prunes. Combine 5 teaspoons lye (available in hardware stores) and 1 gallon water in a large stainless steel or enamelware kettle and heat to just below boiling. Wear rubber gloves to protect your hands and be careful to avoid splattering. Place prunes in a wire strainer and immerse in the lye solution just until skins check or crack—about 5 to 15 seconds (if left too long their skins will peel). Rinse *very thoroughly* under a strong stream of cold water and let drain.

To dispose of lye solution, carefully pour it down a sink drain or toilet bowl. Rinse sink or bowl and utensils with large amounts of cold water.

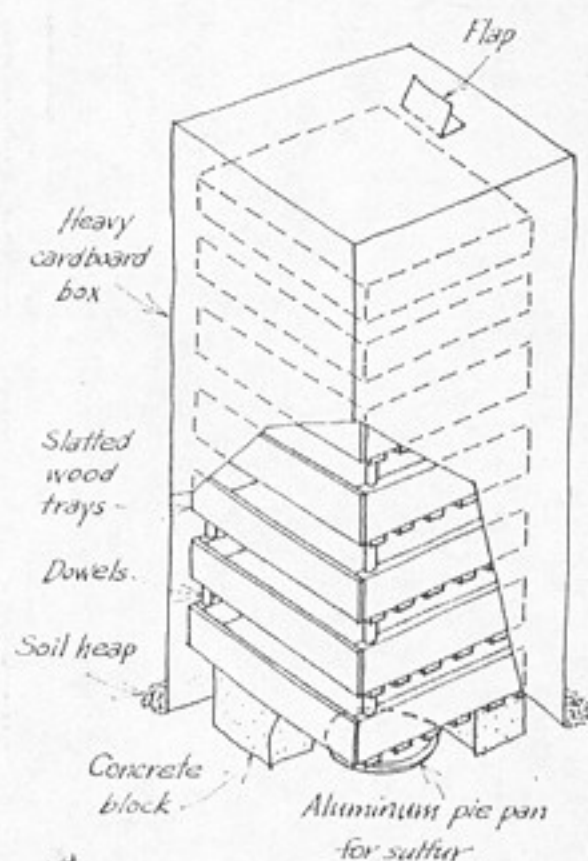
For apples, apricots, nectarines, peaches, and pears

Preventing oxidation by sulfuring (or an alternative method) is necessary before these fruits are put out to dry. Sulfuring requires that the fruit be arranged on wooden trays that, when stacked, allow fumes to circulate freely. Trays made from fruit lugs (see page 153) are an easy, inexpensive solution.

For sulfuring, you'll need a large cardboard box such as the packing cartons large appliances come in—an oven or range carton covers five or six trays, and refrigerator or freezer cartons hold up to about ten trays (appliance stores are usually anxious to give cartons away). It should be free of cracks or holes, but small ones can be covered with masking tape. Cut a flap in the box near the bottom, so you will be able to reach inside to light the sulfur. Cut a flap about the same size in top.

You'll need two concrete building blocks (about 8 by 8 by 16 inches), an 8-inch foil pie pan, and either pure powdered sulfur (available in hardware and some drug stores) or flowers of sulfur (from nurseries or garden supply centers); check the label to see that it is at least 99.8 per cent pure.

Sulfuring must always be done outdoors. Choose a place where there is unplanted dirt or gravel. Dig a shallow pit to hold foil pan. Place concrete blocks on either side of pit about 17 inches apart, then stack drying trays on blocks. Cover all with the cardboard box—it should be at



least 1½ inches larger than the height, width, and length of the stack of trays.

After drying trays are made (directions follow) and your sulfuring box is prepared, you are ready to proceed. Line trays with a double layer of cheesecloth and arrange prepared fruit on cloth the same as for fruits that don't require sulfuring. The weight of cut fruit determines the total amount of sulfur needed (see chart on page 148). Place measured sulfur in the foil pan and place in prepared pit.

It is best to begin sulfuring in late afternoon or early evening so the fruit can remain in the box overnight after sulfuring. Stack trays of fruit on the blocks and cover with sulfuring box. Push dirt against bottom edges of box to seal. If box has bottom flaps, turn to outside and weight flaps with bricks to seal.

Open the two small flaps you cut in the box. Light sulfur with a match. After 5 minutes peek through bottom flap to check that sulfur is burning; if not, relight. When the sulfur is burning well,

close both flaps. The sulfur fumes can be highly irritating, so keep children and pets away. The next morning, remove box and arrange trays in the sun, following directions for untreated fruits.

NOTE: In areas where there is frequent rain, you may find oven-drying your fruit a better method than sun-drying. Since sulfured fruit cannot be oven-dried, you will have to use one of the other ways to prevent browning as described in the publications listed on page 150. They also tell you how to dry fruit in an oven.

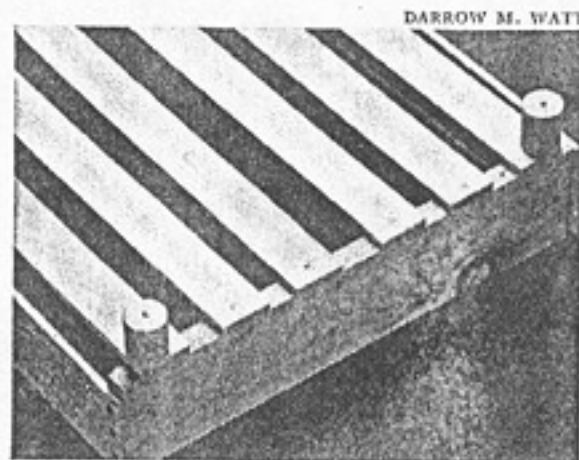
Wood trays for sulfuring and drying

With a few alterations, wood fruit packing lugs (about 17½ by 13½ inches) make excellent drying trays. Often produce managers will give these lugs away or sell them to you. Or build your own wood trays to similar dimensions.

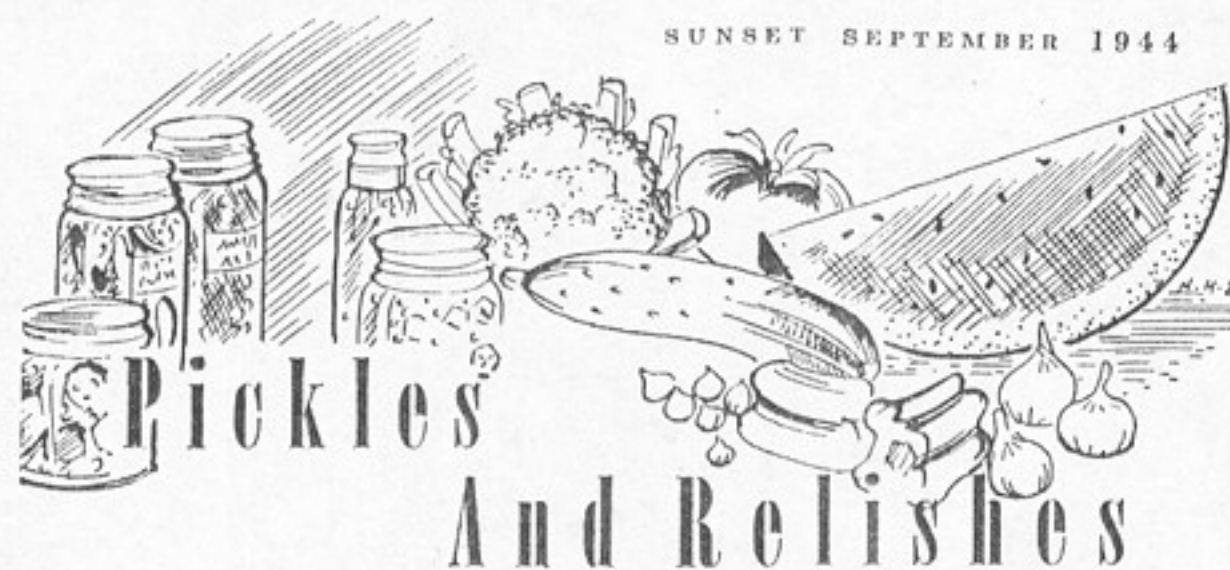
To prepare each tray, remove lug bottoms. From 1¼-inch-wide smooth pine lath, cut six pieces about 17½ inches long. Starting ½ inch from each side of the lug, nail lath about ⅞ inch apart across lug bottom. Use common (non-galvanized) nails to avoid corrosion

caused by sulfur fumes. Cut four 1½-inch-long legs from 1-inch-diameter dowseling, and nail to bottom corners as pictured below.

Each of these drying trays will hold about 1 to 1½ pounds whole apricots or about 15 to 18 pitted apricot halves. If you have a lug of apricots weighing 24 to 26 pounds, and a sulfuring box with a capacity of eight trays, you'll need to do the job in three batches. □



Pieces of dowel on bottom corners let air circulate when trays are stacked



SUNSET SEPTEMBER 1944

PICKLES AND RELISHES accent good food. Pungent and spicy, they point up the flavor of the dishes they accompany, and provide interesting contrast in texture and color. The pickle-and-relish family is a large one. Some of its members, such as dill pickles, require a long-time curing process to develop the desired color, flavor, and texture. Others, including bread-and-butter pickles, fruit pickles, and relishes, require but a short time for preparation. *Sunset* asked Bernice Redington of Berkeley, California, who has made many a batch of pickles in both the research laboratory and the home kitchen, to outline some of the important pointers on making both kinds, and to give us recipes for a few favorites.

First, a word about ingredients. In select-

ing fruits and vegetables for pickling, remember that freshness and good quality are as important here as they are in any other branch of home canning. The food is not going to come out of the jar any better than it went in; if spoilage has started, the finished product may be considerably less desirable than the fresh.

Commercial bottled vinegar of 4% to 6% acidity should be used for pickles. Cider vinegar is the most frequent choice, although the sharper-flavored white (distilled) vinegar is sometimes preferred. Lemon juice is not a satisfactory substitute for vinegar in pickling, because lemon flavor does not hold up under storage except when combined with a large measure of sugar, as in preserves.

Most pickles depend on spices for flavor interest. Turmeric, usually an ingredient in bread-and-butter pickles and mustard pickles, is one spice that has little to offer by way of flavor; it is used chiefly to give a yellow-green tint. Incidentally, if you have difficulty in obtaining stick cinnamon, you can substitute a small dried chili pepper and four whole cloves.

The sugar used in pickles may be brown or white, according to your taste and the complexion you like in pickles. Honey is a possible substitute for sugar, especially in cases where its flavor complements that of the fruit being pickled. (See recipe for Sweet Pickled Watermelon Rind, below.) Saccharine, sometimes discussed as a pickle

sweetener, is not recommended; it develops an "off" flavor in storage.

In selecting a pan for cooking pickles, flameless glass would be the first choice; after that come enamelware, stainless steel, and aluminum, in that order. Iron and tin are not safe here. The same holds true for stirring spoons, dippers, and other utensils involved in pickle-making. Pint fruit jars are the best containers for pickles and relishes, since once the jar is opened, the contents should be used as soon as possible. (Always keep opened jars in a cold place.) Glass-topped jars are preferred because glass is impervious to acid.

Mold on a jar of pickles or relish is dangerous. Mold destroys acid, and thus the contents of the jar, although sour to begin

with, could, through the growth of mold, become non-acid enough to encourage the growth of botulinus organisms. Processing in the boiling-water bath after sealing in hot, sterilized jars is recommended in the case of many pickles and relishes, as a mold preventive. If mold *should* appear, always discard the entire contents of the jar without tasting.

Now for the recipes. First comes a group of pickles that require only "short-term" preparation.

BREAD-AND-BUTTER-STYLE PICKLES

- 4 quarts (16 cups) sliced dill-size cucumbers
- 4 cups sliced white onions
- 4 cups cider vinegar (4% or 5% acidity)
- 2 cups brown or white sugar
- 2 teaspoons each: dill seed and celery seed
- 1 tablespoon each: black and white mustard seed
- 2 teaspoons ground turmeric
- ½ cup salt

To prepare vegetables: Pare cucumbers if skin is tough; cut in ½-inch slices. Wash onions; peel and slice in rings about ¼-inch thick. Cover vegetables with cold water and let stand overnight. In the morning, drain well. Combine remaining ingredients, bring to a rolling boil, and pour over cucumbers and onions; let stand 1 hour. Then bring slowly to scalding or steaming temperature (i.e., to point at which liquid barely simmers around edge of kettle), and hold at this temperature for 20 minutes. Pour into hot, sterilized pint jars, adjust lids, and process in the boiling-water bath for 5 minutes. Makes about 10 pints.

(Note: If pickles show any indication of spoilage upon opening—if there are signs of mold or fermentation bubbles, or if the pickles are soft to the touch—discard entire contents of jar. After opening, store in a cold place, just as you would cooked vegetables.)

Good variations: Substitute thin rings of sweet green or red pepper for half or less of the onion. To prepare pepper rings: Wash peppers and remove stems and cores; slice into rings; cover with boiling water and let stand 10 minutes; drain.

Substitute sliced, unpeeled zucchini for the cucumber. Do not soak zucchini overnight, but follow same recipe otherwise. Tender zucchini makes a better pickle than cucumber that is old enough to have tough seeds. For a decorative (and flavorful) touch, lay a dried chili pepper against the inside of the jar and cover pepper with a scalded bay leaf; pack pickles as usual.



GREEN AND RED PEPPER RELISH

- 6 sweet green peppers
- 6 sweet red peppers
- 1 pod fresh hot red pepper
- 6 medium-sized white onions
- 1 cup brown sugar
- 1½ tablespoons salt
- 1 pint vinegar
- 1 tablespoon mixed pickling spices

Wash peppers and remove stems and cores; scald and peel onions; put vegetables through food chopper, using coarse blade. Bring 1 gallon of water to a boil; add ground vegetables; remove from heat and let stand 5 minutes; drain quickly. Add another gallon of boiling water; let stand 10 minutes; drain well. Add remaining ingredients and hold at simmering temperature for 30 minutes. Pour into hot, sterilized jars (preferably with glass tops) and adjust lids; process in the boiling-water bath, allowing 20 minutes for pints, 30 minutes for quarts.

This relish makes a beautiful jellied salad. Molded in little ring molds, it is especially nice to hold shellfish cocktails. To make the jellied mixture, thin the relish with an equal amount of water; use unflavored gelatin, and allow 1 tablespoon gelatin to each 2 cups of relish-water mixture.

SWEET PICKLED WATERMELON RIND

- 2 quarts (8 cups) prepared watermelon rind
- ½ cup salt
- 4 cups water

To prepare watermelon rind: Remove all pink portion from rind, pare, and cut into small pieces. (Cubes or diamond-shaped pieces are easy to cut; or, you can make balls with a French ball cutter.) Put pieces in an enamelware or crockery bowl; sprinkle with salt and add water; let stand in a cool place overnight. In the morning, drain and rinse well; cover with fresh water and simmer for about 30 minutes, or until rind is clear and slightly tender but not soft;

drain. Combine the following ingredients:

- 4 cups vinegar
- 4 cups water
- 5 cups sugar (honey can be substituted for half this measure)
- 1 tablespoon whole cloves
- 1 stick cinnamon or 2 dried chili peppers
- 1 tablespoon whole ginger root, clipped in small pieces

Bring to a boil and pour over rind; simmer gently for 30 minutes; let stand overnight. The next day, simmer in a wide, shallow pan until syrup begins to thicken and a piece of the rind is clear when cooled. Pack rind in hot, sterilized jars and cover with boiling syrup; adjust jar lids and process in the boiling-water bath for 5 minutes.

A good variation: Use melon juice in place of the water, and reduce the amount of sugar by at least 1 cup.

TOMATO CATSUP

- 18 pounds firm, ripe, sound, highly colored tomatoes
- 1 tablespoon paprika
- ¼ teaspoon cayenne
- 1 tablespoon dry mustard
- ½ cup mixed pickling spices
- ½ cup chopped onion
- 2 cups white (distilled) vinegar
- 2 tablespoons salt
- ¾ cup sugar

Wash tomatoes well, drain, and remove any imperfections; slice coarsely into a deep aluminum or enamelware kettle. Boil 3 minutes, crushing well; force through sieve, food mill, or ricer. Mix paprika, cayenne, and mustard together; blend with the tomato puree, and start boiling in a wide, shallow pan. (A turkey roaster is a good utensil.) Tie mixed pickling spices and onion together in a cheesecloth bag; add to tomato. Cook rapidly until very thick, stirring frequently to prevent sticking and scorching. (This will require 30 to 60 minutes, depending on the size of the pan and how rapidly the mixture boils.) Then add combined vinegar, salt, and sugar; boil 5 minutes longer. Pour boiling hot into hot, sterilized glass-top jars, seal tightly, and invert to cool. Or, if a bottle capper is available, pour into hot, sterilized bottles, seal with beer caps, and invert to cool. Makes about 4 pints (8 cups).



DILL PICKLES

Next, a recipe for dill pickles, which, as noted above, require "long-term" preparation. The principle behind the making of dill pickles is simply this: A brine of salt and water is added to the cucumbers and they are allowed to stand until the desired changes in color, flavor, and texture have taken place. During this time, the fermentable sugars present in the cucumbers are drawn out by the force known as osmosis, and are converted into lactic acid by the lactic-acid bacteria normally present on the vegetable.

This process is known as fermentation. The combination of salt and lactic acid is what preserves the vegetables.

While fermentation is taking place, it is important that the pickles be stored in a container which will keep out harmful organisms present in the air, and still allow the gas formed during fermentation to escape. The best dill pickles are made in closed oak barrels, but a stoneware crock can be used if the directions given below

are closely observed.

A clean plate, of a size to just fit down inside the crock, should be placed on top of the cucumbers, and the plate should be weighted down with a clean rock, or with a jar or bowl of water, so that the cucumbers will be well submerged in the brine.

If brine is lost during fermentation, it should be replaced so that the pickles will be submerged at all times. Any scum on the surface must be skimmed off as rapidly as it appears.

The time required for the completion of fermentation will depend on the temperature at which the pickles are stored. A slightly warm, even temperature—70° to 80° F.—is best. Avoid sunlight; it will kill the lactic-acid bacteria.

Once active fermentation has ceased (i.e., when the brine has stopped bubbling and

the cucumbers have acquired the right color, flavor, and crispness), the pickles should be sealed in air-tight jars; glass-top jars are recommended.



Here are specific directions which may be used with green tomatoes and green peppers as well as with cucumbers:

- ¾ pound fresh dill, or 4 ounces dill seed
- 3 dozen dill-size cucumbers
- 1 teaspoon each: whole cloves, coriander seeds, and peppercorns
- 4 bay leaves
- 2 cups salt
- 8 quarts water
- 2 cups vinegar

Spread about ¼ of the dill in the bottom of a scalded stoneware crock. Pack the washed cucumbers in firmly but without bruising them, sprinkling the spices and remaining dill through them. Stir salt and water together until salt is dissolved; add vinegar; pour over cucumbers. Lay a plate on top of the cucumbers and weight it down with a clean rock, or with a jar or bowl of water. Let stand about 2 months, or as long as required to complete fermentation. Remove scum as it appears, and replace brine, if necessary, to keep it up to its original volume. When fermentation ceases, drain and rinse the cucumbers, and pack them in sterilized, glass-top jars. Bring the strained brine to a boil, pour it over the pickles, and seal.

(Note: If at any time the pickles become soft and slimy, or develop an unpleasant odor, discard them completely.)

SUNSET

AUGUST 1945

Camp cookery

How to use pit, Dutch, and reflector ovens

THIS ROUND-UP of outdoor cooking ideas comes from no one expert. Many of the ideas are from camper-author Doreen Foote of Long Beach, California. All ideas have been reviewed by a Sunset reader panel made up of these outdoor cooking experts and observers: Mrs. Robert Abel, Lana Christensen, M. L. Cornell, George A. Cox, F. S. Cronemiller, Trevor Evans, Josephine M. Foley, Oliver Kehrlein, Thomas C. Larter, Gerald Longstreth, George R. Miller, R. S. Simmons, Elsey Smith, M. T. Mirov, Dr. F. W. Went, and Mr. and Mrs. Ede J. Wilson.

There can be no complete agreement on the subject of outdoor cooking. Each method of cooking comes in for both praise and censure, depending upon the objective of the cook. Some experts (perhaps the most practical) give time and study to equipment that duplicates, as far as possible, the conveniences of the modern kitchen. They laugh at the rugged Indian-scout methods. They believe that the full duty of the camp cook is to provide clean, palatable food in the quickest possible time. On the other hand, there are those who really enjoy experimenting with the most primitive methods. Hot-rock and ash-oven cooking are interesting challenges to such cooks' skill and ingenuity. They are perfectly willing to spend time and energy to prove that they can get along without even the simplest cooking utensils and equipment. In reporting these ideas, we make no attempt to outline the best method of providing food out-of-doors. We have pur-

posely omitted from this report the most frequently used methods of cooking. We say very little about the frying pan, not because we decry its use, but because the way in which it is used is just as much a matter of skill indoors as outdoors.

Many of the ideas are admittedly stunts—worth trying once, or worthwhile when entertaining children.

The final test of any method used in any type of cooking is whether or not the end product is something good to eat. As long as the objective of cooking out-of-doors is to give to food a flavor or an interest difficult to duplicate by conventional methods, that type of cooking will continue to be respected and studied.

For example, some of our experts objected strenuously to any method of pit cooking. They pointed out that it required much time and labor that could be better spent in enjoying the out-of-doors. "Why," asked Oliver Kehrlein, "give up the best part of the day digging a hole in the ground (blisters); building a rock-lined well (jammed fingers); gathering a countryside of wood (back-aches); and then sitting around waiting for food to bake? For over a half a century I have been providing suste-

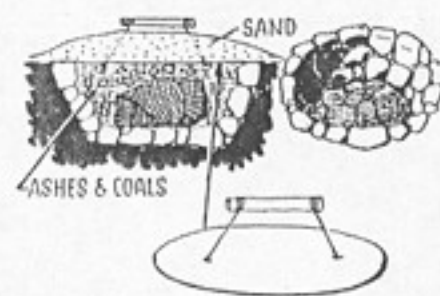
nance for the inner man, for myself, and for over 200 Sierrans at a time, and have yet to see a real outdoorsman bake in a pit." Those who support the idea of pit cooking point out that one of their greatest pleasures in camping is "fixing up a good base camp," and, further, that you really don't have to sit around and wait, nor do you

have to gather additional wood. By building a breakfast fire in the pit, it is ready to receive the food for your dinner by the time breakfast is over. When the sports of the day are finished, all you need to do is lift out a beautifully baked dinner.

But again the question of whether it is wise or foolish to bother about pit cooking is in most part a matter of taste. If you enjoy spending your time building a pit, that's your brand of enjoyment, and you're entitled to it. We feel that there is a possibility that the outdoor oven—either a pit in the ground, or the raised Mexican or beehive oven, or the use of their principles in conjunction with a barbecue—may provide new and interesting food flavors. In reporting on it, we give due credit to those who have pointed out its disadvantages as well as to those who have praised it.

OVENS

The accepted version of rock-lined pit construction is as follows: Allow a space about three times as large as the food you are going to cook. Slope the sides of the pit a little. Line the bottom and sides with rocks, chopping flat ones which will not tend to roll down to the bottom. Build a fire in the pit and let it burn briskly for 3 or 4 hours, or until the pit is filled with hot coals. Then shovel these out and place the food in the pit. The food should be well wrapped in wet parchment paper or



put in a wet cloth bag. Cover the wrapped food with coals, then put a layer of sand or dirt over the coals so that none of the steam can escape. Time of cooking will depend on amount and kind of food.

Some experts advise wrapping the cloth-covered food in four thicknesses of damp newspaper. This holds the heat better, and the cloth will not get brown spots on it from the coals or rocks.

Shepherders throughout the West have used this type of oven for years. Whether or not rocks are used depends on the type of soil. Sandy or granitic soil tends to slide into the pit, unless rocks are used.



The Mexican or Spanish oven employs the same principles of heat. Bricks, stone, or adobe, or a combination of all three are used to build a dome-shaped oven. By building a fire in the oven floor, the rocks or bricks are preheated for two hours or more. The fire, coals, and ashes are then scraped out of the oven. Food is inserted and the oven closed. The stored-up heat does the roasting.

and take them out the next day when you entertain. This makes recipes with a long cooking time a boon. A hoe is handy for lifting out the pot, or you can attach a wire to the handle. The 'lifting of the pot' is an effective pre-meal ceremony. I employ a simple labor-saver in my pit. It's a round piece of sheet iron with a wire handle. By placing this over the coals and throwing sand on it, I am able to lift most of the sand out clean in one operation."

The pit has an extensive historical background, having been used for centuries throughout the islands of the Pacific.

A square brick pit built alongside the barbecue is an adaptation that combines the characteristics of both the hole in the ground and the Mexican oven. Since one course of bricks will not hold sufficient heat for long-time roasting, the coals should be used to cover the food, as in pit cooking. If a regular roaster is used in such a pit, there is no need to wrap the food.

A Seattle expert who has built a permanent cement-and-rock-lined pit in his backyard reports: "One advantage of pit cooking is that you can build your fire one day, put your beans or what have you on to cook,

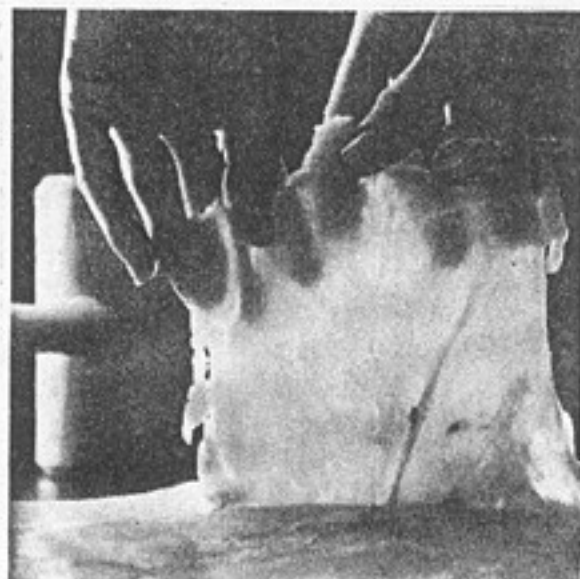
NEW ZEALAND VARIATION

From Mr. and Mrs. Ede J. Wilson of Palo Alto, California, comes a description of a pit dinner cooked for them by a friend who had lived in New Zealand for several years

He had attended many of the festivities of the New Zealand natives, at which food for two or three hundred people was cooked in rock-lined pits. Here's the preparation story of the dinner which the Wilsons enjoyed. Say they, "The delectable flavor lingers yet in our memories."

Early in the morning, a fire was built in a large pit lined with big, boulder-like rocks. In the afternoon, a very few of the larger heavier coals were removed, and about a quart of water was thrown on the remaining coals, causing a huge amount of steam to arise. Wet gunny-sacks were immediately thrown over this hot, steaming mass. In separate large, clean, wet dish towels were wrapped quantities of pork chops, husked corn, and peeled potatoes, all salted (Salt was the only seasoning used.) The wrapped food was placed quickly on top of the wet gunny-sacks, then another layer of wet gunny-sacks was placed over the food. Gunny-sacks were also put in around the sides of the pit to prevent dirt from slipping in. Coals were put on top of the gunny-sacks, and dirt was then placed on top of it all. Cooking time was five hours. When the dirt was removed, the chef was very careful not to let any dirt or coals get below his top layer of gunny-sacks. He folded the sacks carefully as he removed them, keeping the dirt always on their inner fold.

SUNSET OCTOBER, 1969



Boned chicken breast, pounded so thin you can see through it; sauté for new entrée

*First you pound
your chicken*

The simple mechanical technique of pounding turns chicken breasts and thighs into a new kind of meat dish. The meat cooks in just a minute or two and is remarkably tender, with great similarity to veal. Here we season it very delicately, but any sauce you might choose for sautéed veal could be spooned over at serving time.

CHICKEN SCHNITZEL

For each serving allow about ½ pound chicken breast (1 small or ½ large whole breast) or 2 thighs. Bone and skin; if breasts are whole, cut in halves.

Place pieces of meat on a large sheet of waxed paper (or do a few pieces at a time), arranging 5 or 6 inches apart. Cover with waxed paper and pound meat firmly with a flat-surfaced mallet until each piece is 2½ to 3 times larger in size. Occasionally you will need to replace paper as it tears. Take care to avoid breaking meat apart with uneven blows. Gently ease chicken from paper. Cook at once or transfer to fresh waxed paper, laying out smoothly; wrap and chill.

To season, sprinkle lightly with salt; you can also dust sparingly with a crumbled dried herb such as basil, sage, dill weed, oregano, or marjoram; seasoned pepper; or seasoned salt (omit plain salt).

To cook, melt only enough butter or margarine in a frying pan to coat bottom. Over high heat cook chicken without crowding just until edges turn light. Turn and cook until meat changes from pink to white on all sides and begins to brown lightly; takes 1 to 1½ minutes. Add butter to pan when needed to prevent sticking, but in small quantities because it burns if used too generously. Keep meat warm as cooked. Accompany with lemon wedges to squeeze over if desired.



A platter of warm, meat-filled empanadas served with green salad and white wine

SUNSET

Treats from South America

South American empanadas are an excellent choice for a casual buffet dinner or party. They differ from the spicy and rather sweet Mexican empanadas; these are deep-fried pastry turnovers filled with seasoned meat mixtures or cheese. You serve them as an entrée, with greens or a fruit salad and a refreshing drink (in South America the drink is usually dry Sherry or white table wine). Custard, sherbet, or fruit is a suitable dessert.

While empanadas can be family fare, they are particularly good for entertaining because you can prepare them in advance, freeze them, and then cook them shortly before serving. (You can keep the meat-filled ones warm in the oven for an hour or even reheat them without affecting their quality. The cheese empanadas are best eaten shortly after they're fried.) We begin with the basic directions for making empanadas and then give recipes for three fillings—pork, beef, and cheese. It is nice to serve a combination platter—plan on three empanadas per serving.

BASIC EMPANADA RECIPE

- 4 cups unsifted flour
- 2 teaspoons salt
- 1½ cups shortening
- ¾ cup cold water
- Pork, beef, or cheese filling (recipes below)

Measure flour into a large mixing bowl; mix in salt. Cut in shortening with a pastry blender or 2 knives until consis-

tency of cornmeal. Sprinkle water over top and mix in with a fork. Shape dough into 3 balls; chill 30 minutes or longer. Roll out each ball into a very thin sheet, about 1/16 inch. Use a small plate (6 to 7 inches in diameter) as a pattern to cut out rounds of dough. Spoon 2 to 3 tablespoons of meat filling or a piece of cheese on one side of round; brush water around the edge with your finger. Fold free half



Fold half of pastry round over seasoned meat filling; then seal and crimp edges

over filling; pinch edges together and crimp. Slip empanadas into 2 inches of hot cooking oil (400°) in a frying pan. Cook 2½ to 3 minutes per side, or until golden. Use tongs to turn and remove

empanadas to a cooky sheet lined with a triple thickness of paper toweling. Keep in warm oven (175°) until time to serve. Makes 24 empanadas.

To freeze uncooked empanadas, stack tightly in a box or pan and cover with foil. When ready to deep-fry, spread them out on a cooky sheet and thaw at room temperature about 2 hours; cook as directed above.

To reheat cooked empanadas you've stored in the refrigerator, place them on a cooky sheet and heat in a moderately slow oven (300°) for 12 minutes.

Pork Filling (Empanadas de Puerco)

- 1½ pounds lean pork shoulder chops
- 1 teaspoon garlic salt
- ¼ teaspoon pepper
- Water
- 2 medium-sized tomatoes, halved and thinly sliced
- ½ green pepper, seeded and chopped
- 4 green onion bulbs, sliced
- ½ cup raisins
- 2 tablespoons salad oil
- 1 can (8 oz.) pitted olives, halved
- 4 hard-cooked eggs, chopped
- 1 teaspoon salt
- ¼ teaspoon pepper

Season pork chops with garlic salt and pepper. Put about ½ inch water in a large frying pan over medium heat; add chops; cook uncovered until well done (about 8 minutes per side). Dice.

Combine tomatoes, green pepper, onions, and raisins, and cook in oil in a saucepan over medium heat about 5 minutes, stirring occasionally. Remove from heat; combine with pork, olives, chopped eggs, salt, and pepper. Complete as directed above. Makes 24.—F. M., Stanford, Calif.

Beef Filling (Empanadas de Carne)

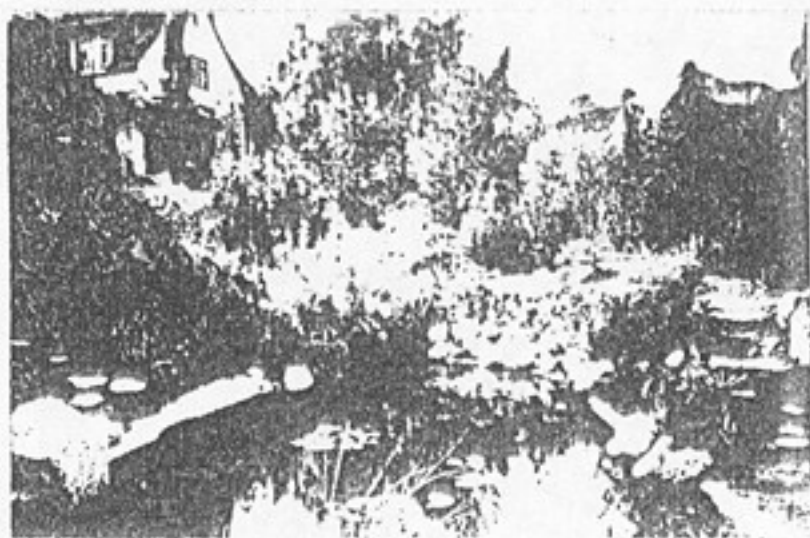
- 1½ pounds ground beef round
- 1 clove garlic, mashed
- 1 teaspoon salt
- ¼ teaspoon pepper
- ½ cup chopped onion
- 2 tablespoons butter
- 2 medium-sized tomatoes, halved and thinly sliced
- ½ cup raisins
- 1 can (2¼ oz.) sliced olives

Season ground round with the garlic, salt, and pepper. Meanwhile, sauté onion in butter until golden; stir in meat; brown. Remove from heat; stir in tomatoes, raisins, and olives. Continue as above. Makes 24.—C. V., Menlo Park, Calif.

Cheese Filling (Empanadas de Queso)

- 1½ pounds jack or cheddar cheese
- 2 canned green chiles, cut in thin strips (optional)

Cut ½ inch thick slices of cheese in triangles with each side about 2 inches long. Place on the pastry round with a strip of green chile, if you use it. Continue as directed above. Makes 24 empanadas.



A GARDEN LILY POOL

WONDERLAND OF KNOWLEDGE, 1938

An Inexpensive Concrete Ornament

Ornamental pools are a never-ending source of delight. From early spring until late in fall, your garden pool sets a beautiful stage for enjoyment of colorful fish and aquatic plants. The ornamental pool is the center of enjoyment in your "outdoor living room."

The general character of your garden—whether it is formal, or informal in a natural setting—will suggest the style.

Small species of water lilies require only a small pool—3 feet or more in diameter. Larger varieties must have a pool at least 6 feet wide. Depth depends upon the type of planting. For water lilies, a depth of at least 22 inches is desirable.

Garden pools may be combined with rock gardens, often with a miniature water-fall running down a rocky course into the pool.

Excavate to the required depth, includ-

ing the thickness of the floor. Pools with vertical sides are built with forms. If the soil is firm, no outside form is needed.

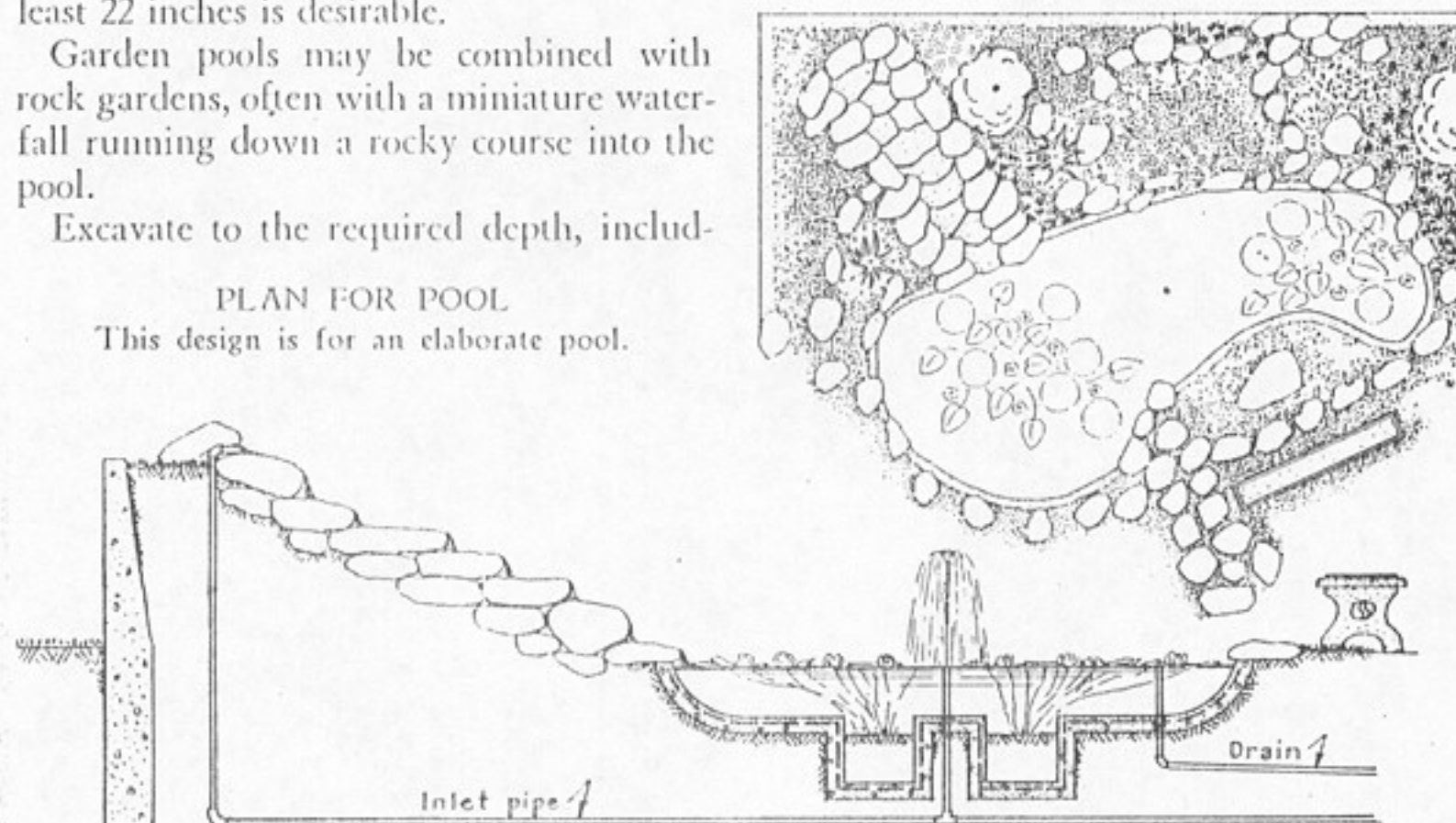
Pools with sloping sides often are built by "plastering" a stiff concrete in place. Wire-mesh reinforcement is used. Natural rock may be set in the concrete.

Pools having walls of curved or irregular shape are made with forms of 20-gauge galvanized iron, readily bent to the desired shape.

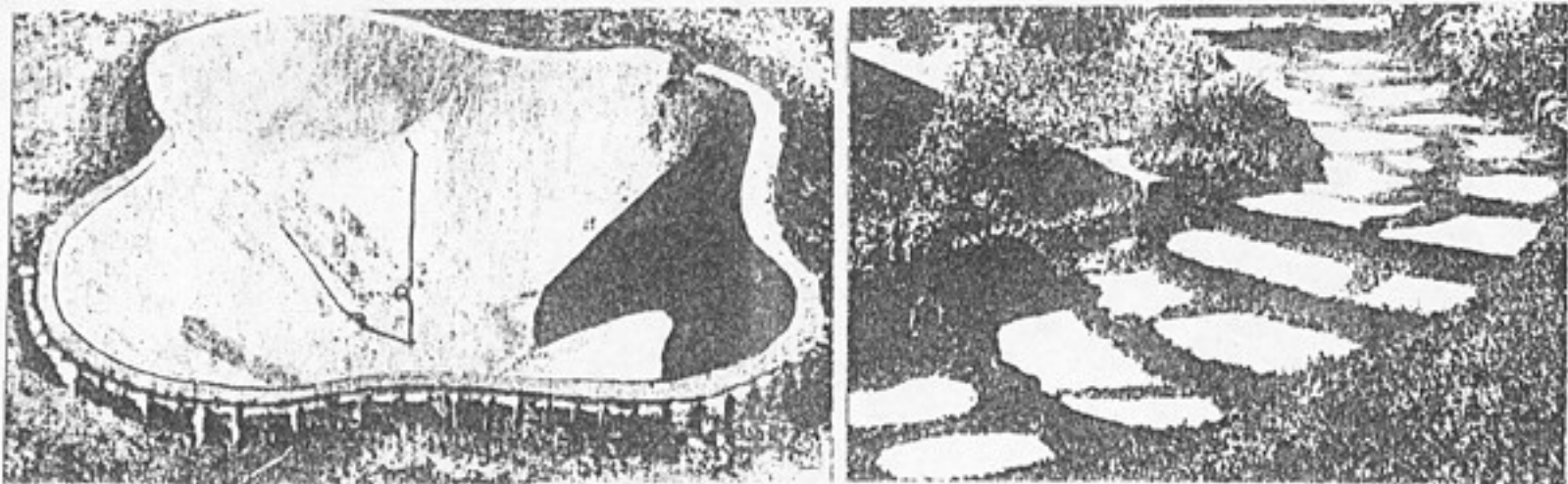
Reinforcement should be used as shown in the accompanying drawings. Place the floor and walls in one operation to avoid construction joints.

PLAN FOR POOL

This design is for an elaborate pool.



All pictures courtesy Portland Cement Association



USING CONCRETE FOR DECORATION

Left, a concrete lily pool almost finished. The concrete was plastered instead of poured into a form. The picture at right shows a concrete flagstone walk.

Support the interior wall forms across the top of the excavation so that the bottom hangs 6 inches from the bottom of the pit. Spreaders, or braces, extending across the pool from one form to the other, prevent bulging when the forms are filled with concrete.

Oil the inside of the forms so that concrete will not stick to them. First place the concrete for the floors. Then deposit the concrete for the walls in 6- or 8-inch layers all around the pool, spading each layer as it is placed. A garden hoe, straightened out, makes a good spading tool.

Often, pools are built partly above grade. A foundation 2 or 3 feet deep should be used.

The pool may be filled with a garden hose or connected with the regular water supply. It may be emptied with a pail or a built-in drain.

Make any plumbing connections before the concrete is placed.

Making the Concrete. Strong, durable, watertight concrete is easily made. Most

important is the amount of water used per sack of cement. Use about 4½ to 5 gallons of water per sack.

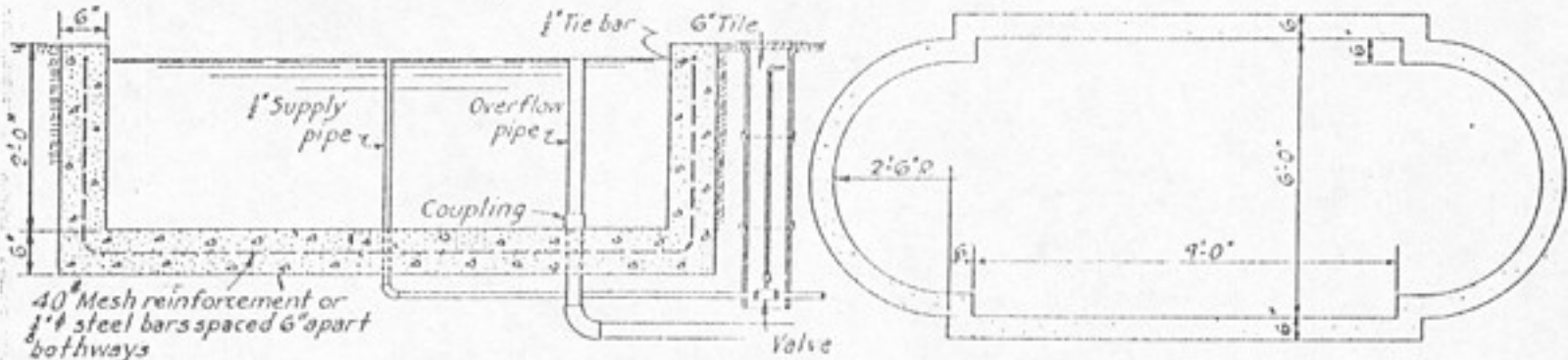
The correct mix (determined by a trial batch) should be plastic, holding its shape well, but not crumbly. If too stiff, use slightly less sand and gravel; if "runny," add sand and gravel until the proper proportion is obtained.

(1) Make a dry mix of about 1 part Portland cement, 2 parts clean, sharp sand, 2½ to 3 parts clean gravel. Mix thoroughly until the color is uniform—no gray or brown streaks.

(2) Add correct amount of water and mix until sand and pebbles are thoroughly coated with cement paste.

The concrete should be placed within 30 minutes.

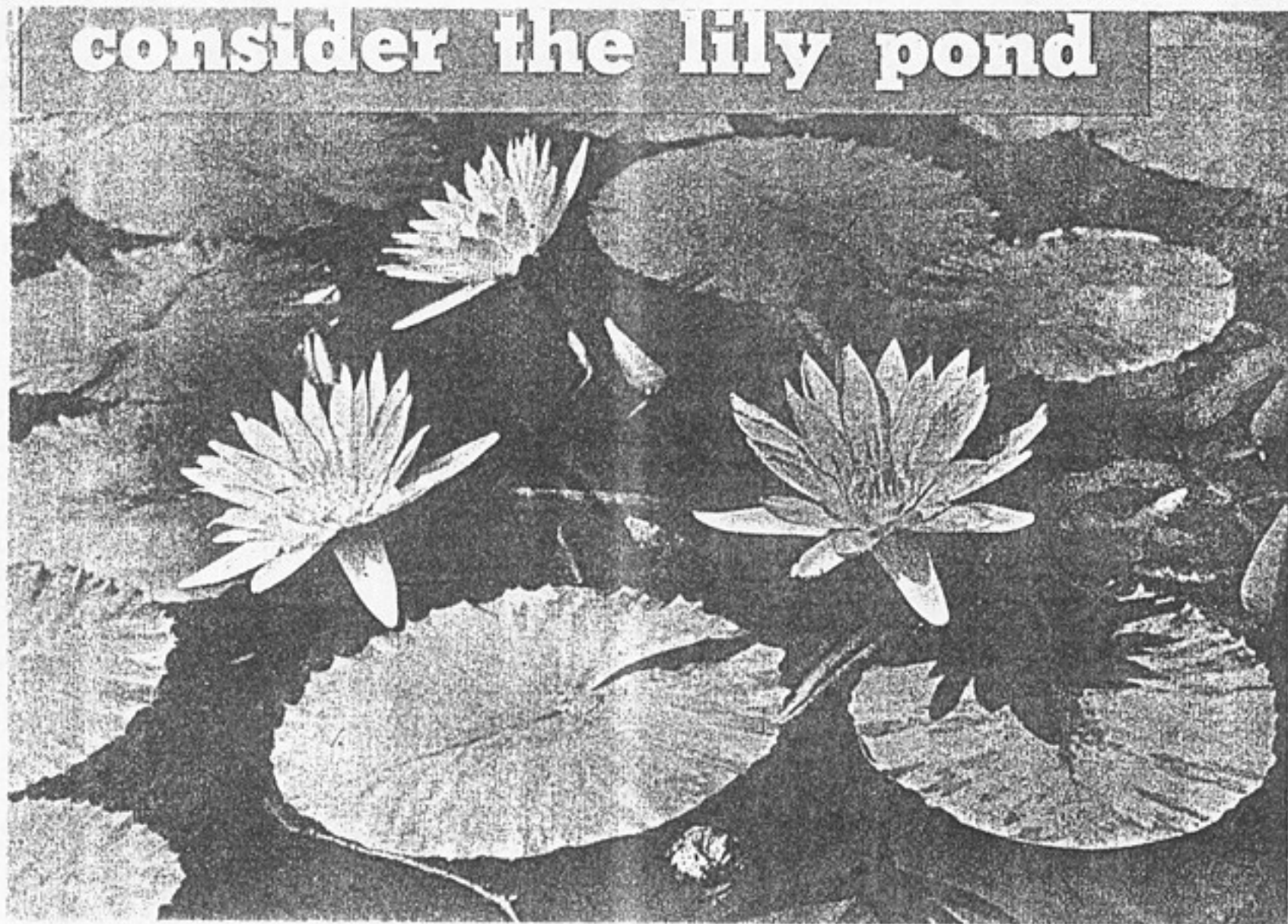
Do not permit newly placed concrete to dry out. Protect it from sun and drying wind for a week to 10 days. A covering of burlap or canvas, sprinkled often enough to keep it moist, is a satisfactory covering while curing.



DETAILS FOR A SIMPLE GARDEN POOL

This attractive pool for lawn or garden can be built cheaply and in a comparatively short time with concrete. Notice how the water pipes are placed.

consider the lily pond



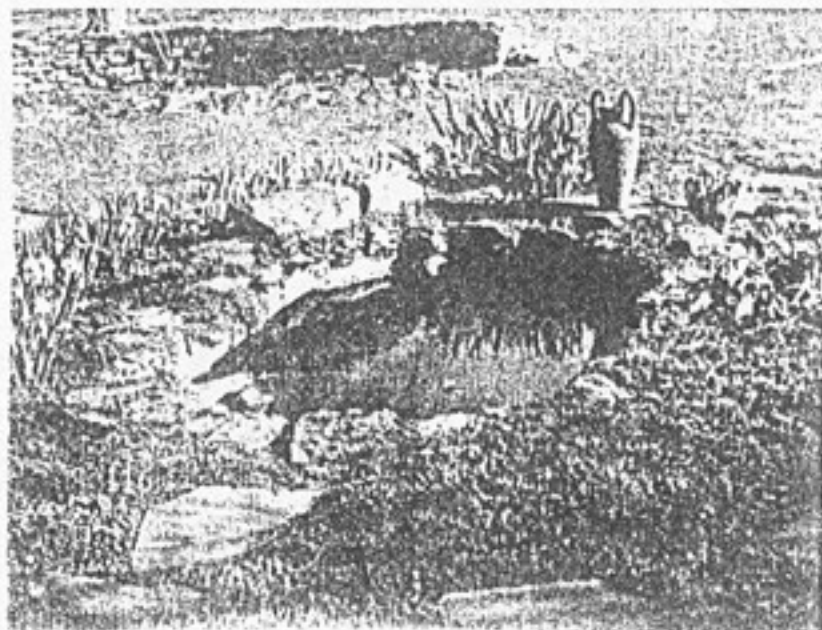
Mechanix Illustrated
May, 1951

*Add serenity and a sense of luxury to
your landscape by building a flower pool.*

By John P. Arnold

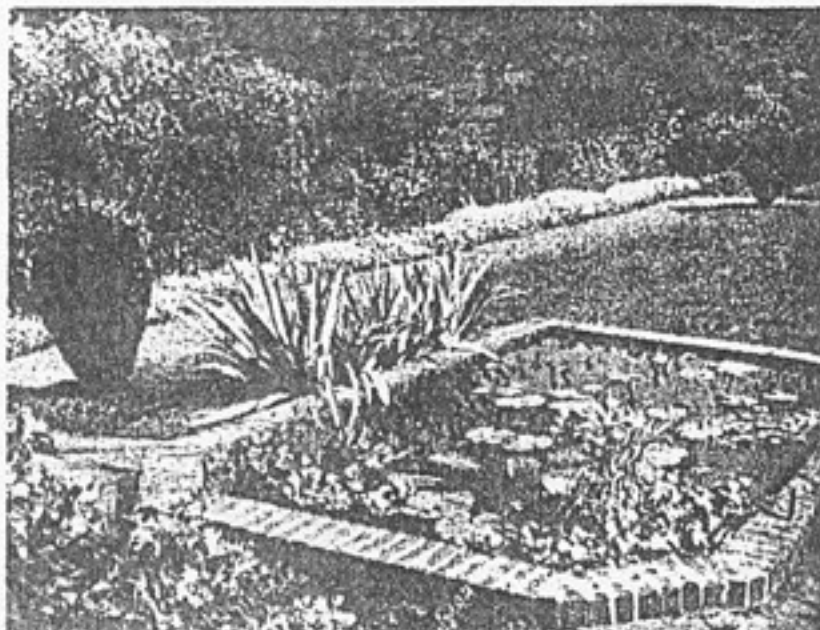
IF you think that a lily pool is too complicated a project for your garden, you're wrong. There's nothing difficult about it, but here are a few pointers you should know before building.

Spoon-shaped pond has field stone, plants and turf along its rim to accentuate natural setting.



Water lilies may be classified as either hardy perennials which will winter outdoors as long as their roots are not frozen, and tropical annuals which have to be replaced every year. Flower fanciers usually

More formal project follows the general layout of the garden and is accordingly rectangular.



prefer the latter because they are more showy, and your pool should be planned with these in mind.

Ideally, in northern latitudes, a pool should be sheltered from the rude north-east winds by a tree windbreak or shrubbery. An unobstructed exposure to the south is highly desirable.

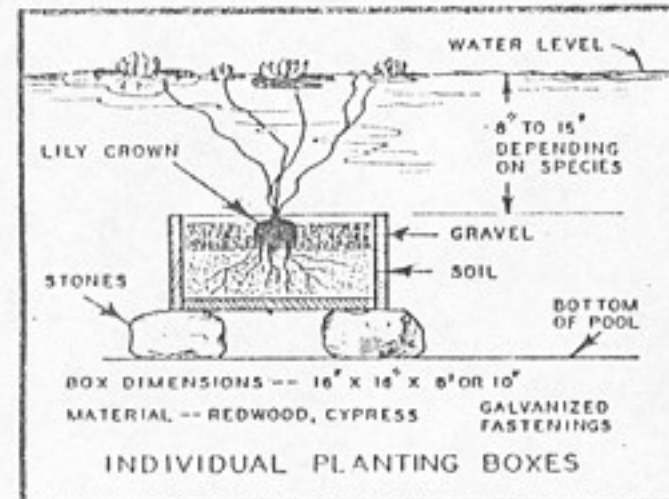
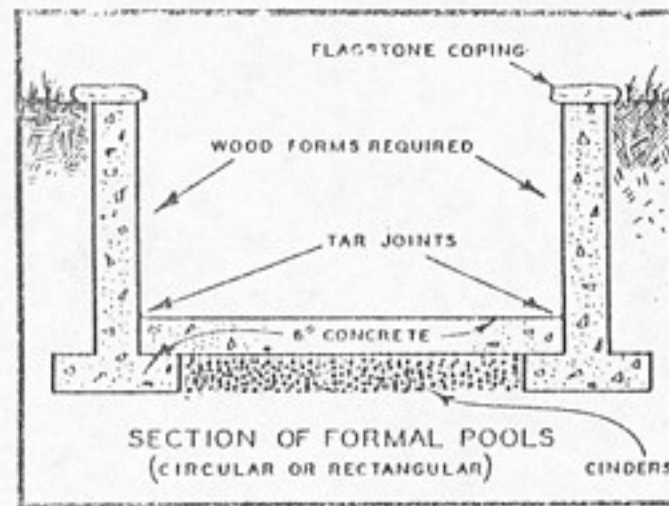
Although natural pools with earthen sides can be built by damming running water, a small pool in a spot distant from a water source should be made of concrete. With smaller pools a constant source of running water is neither necessary nor desirable. You merely have to replace losses due to evaporation and leakage to maintain a constant level, and this can be done with a hose. Plant life and a few goldfish will prevent stagnation and mosquito breeding.

There are two general types of pools: those of geometric form (square, round or oval) for formal surroundings and those of irregular shape (tear-drop or spoon-shaped) to conform with natural surroundings. The latter are somewhat easier to build, as forms for setting concrete are not required.

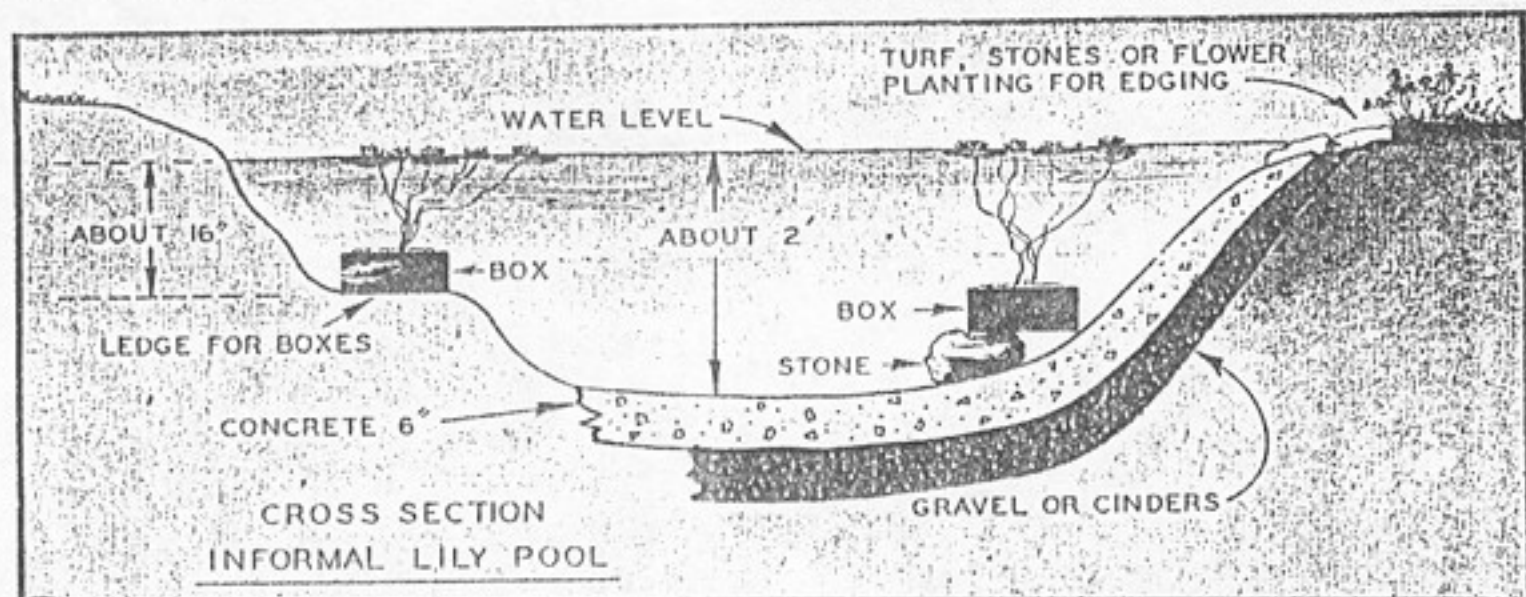
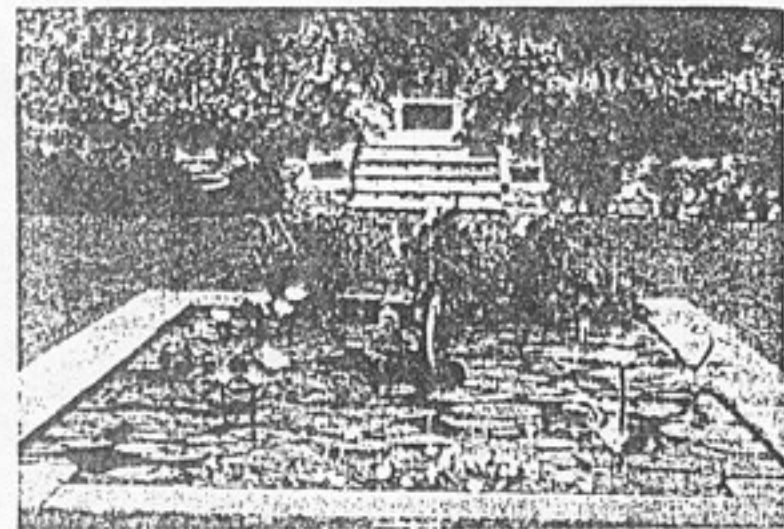
The size of a pool will of course be limited by the amount of space that can be devoted to it, but the number of water lily crowns (or tubers) planted in a given pool should allow a minimum of 16 sq. ft. of water surface for each plant, which is equivalent to planting the roots about 4 ft. apart.

The portions planted to lilies should be fairly shallow. The water level above the crowns of young tropical annuals should be no more than 8 in. and about 16 in. for mature plants. Therefore the maximum depth of your pool should be about 2 ft. Try to maintain the water at a constant level.

The ground is dug away to the desired size, allowing about a foot to be occupied by a gravel base and concrete casing. The base may not be necessary if the soil is light and well drained. A 6-in. layer of concrete of 1:2:3 mix



A pool this size should have underground pipes from water supply and for occasional draining.



(1 part cement; 2 parts sharp sand; 3 parts aggregate or crushed graded stone) is then poured in one operation working from the center of the pool up to the sides. Crushed chicken wire, reinforcing rods or junk iron should be embedded in the pouring to stiffen the work to prevent cracking.

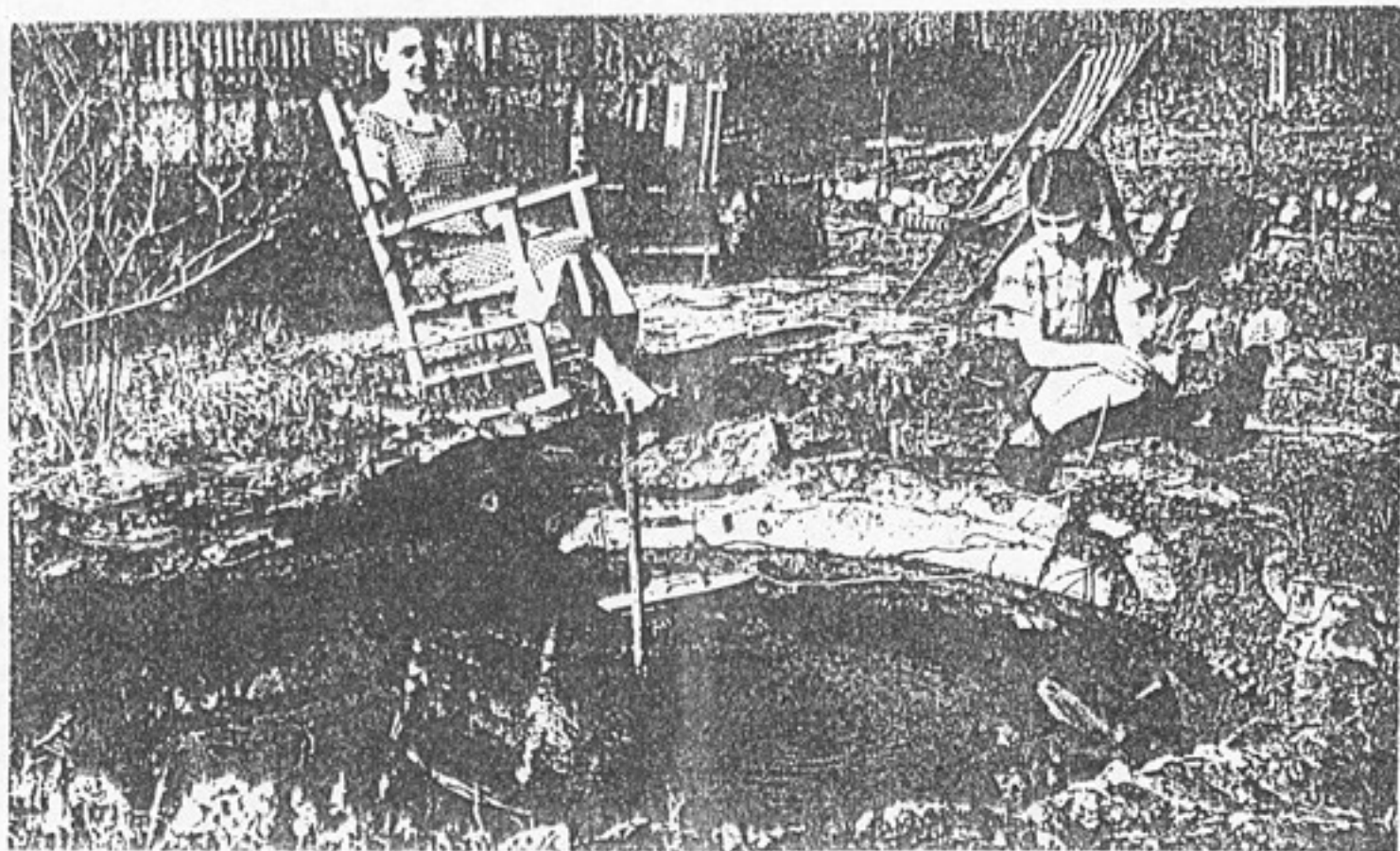
The concrete is roughly troweled, but before it has set the surface should be coated with a rich mixture of 1 part cement to 1 part sand. The concrete should then be covered with straw. Permit two weeks for curing.

If running water has been utilized or if rain water is likely to flood the pond, an overflow pipe or masonry spillway should be provided to convey excess water to lower ground. Lengths of 2-in. pipe and a tile underdrain will prove sufficient.

In either earthen or concrete pools, lilies are best planted in boxes of rich soil and placed in the pool, setting the boxes on flat

stones to raise the crowns to the proper distance below the water level. Or the sides of the pool might be shelved as shown to provide a ledge on which to place the boxes. Such boxes should be made of redwood or cypress, 8 in. deep and 16 in. square, and nailed or screwed together with brass or galvanized fastenings. The boxes should of course be positioned before the pool is filled.

Hardy plants are left in the water the year round. The roots should be divided every two or three years as in the case of iris, peonies and other plants. The lily pool should not be cleaned entirely at any time and a certain amount of soil and leaves should be allowed to settle to the bottom as the roots straggle out of the boxes and feed on this rich material. If green slime tends to form in the pool at certain seasons, it can be avoided by adding 1 oz. of potassium permanganate for every 12-14 gallons of water. •



Mechanix Illustrated

JULY, 1953

Garden Pool

Decorative, and useful, too, is this garden project that's well within anyone's ability to build.

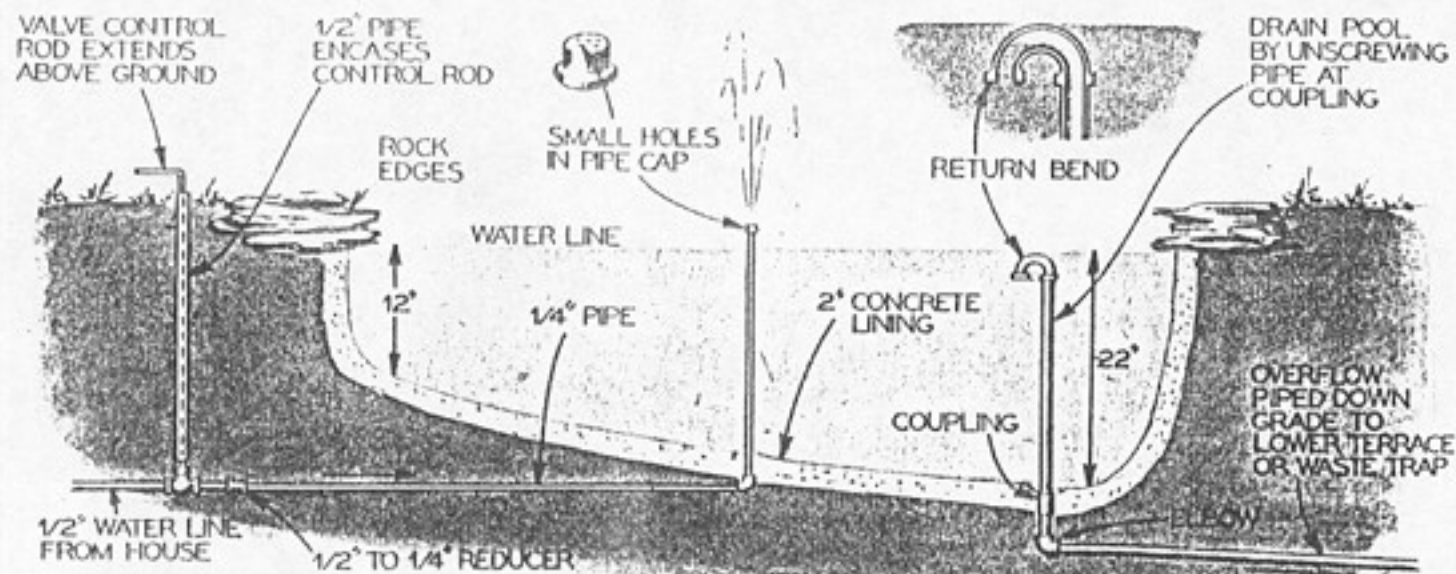
By Harry M. Campbell

WE built a good seven-foot garden pool, including a fountain and rock garden, for only \$10 in actual cash, plus about 18 hours of work.

It is quite a simple matter to build your own pool, and if you do all of the work it will give you far more personal satisfaction than one built for you at much higher cost. The actual labor involved is no more

difficult than ordinary garden work, but results prove more practical. For aside from the beauty which this creation adds to your garden, you get mosquito protection, and a central feature for further landscaping.

The first consideration is the type of pool and its location. These two important factors should be



linked together to create a harmonious effect. For a formal garden this may be something of a problem, but not for the average informal garden. You can never go wrong in choosing a pool of irregular shape, adapted to any logical site—preferably some sunny spot. A sloping lot offers no problem, although it does require different planning. In our case, with a lateral drop of more than three feet in 65 feet of width, we combined our pool with a rock garden, and later terraced the lot in three tiers.

We chose a fairly central location between two large trees, which gives us beautiful shadow effects at any hour of the day. We visualized the pool as the logical center for a planned arrangement of rock-paved patio, trellis, gateway, and shrubbery, including crape myrtle for added color. It so happened that our water line, with a spigot extending above ground, was close by, eliminating much digging and providing an easy plumbing arrangement.

It is best to start digging at the center, extending the hole gradually into the desired shape until it is deeper and larger than the dimensions planned for the pool by the thickness of the concrete needed. This latter question will depend upon the climatic conditions. In the deep South we seldom have severe freezing weather, so we have found that two inches of concrete is sufficient. Our fountain runs all winter, providing a trickle of fresh water to prevent possible freezing over, and to supply the fish with needed oxygen.

We dug our pit about 14 in. deep at one end and 24 in. at the other, with a sump at the lower end. This allows quick and easy cleaning, eliminating an otherwise nasty job.

By digging a narrow trench between this lower end of the pit and the water spigot nearby, it was an easy matter to install the piping and drain. Used fittings, pipe, and a valve (just as good for this purpose as new materials) were purchased at a total cost of four dollars, including cutting and threading

pipe to measure. One-quarter-inch pipe is fine for the fountain, but the drain pipe should be at least three-quarter-inch in diameter for satisfactory results.

After shutting off the water at the meter, the first connection is made to the supply line through a reducing tee. All joints should be snugged up water-tight, using plumbers' joint compound or paint on all threads. After the valve is connected it may be closed and the water turned on again. The fountain control lever is a length of valve rod, connected to the top of the valve below, with a right-angle bend at the top. This rod should run through a piece of pipe to prevent dirt packing around it as the trench is filled.

The small-bore piping is then continued from the valve to the point selected for the fountain. There are many ingenious possibilities here. One very effective arrangement allows the water to trickle from between the rocks above the pool. Ours comes up through the center (where I intend to have a small statue when a suitable one is found), ending in a spray provided by a pipe cap with small holes in its top.

The drain may require more planning. It will be necessary to run it down-grade on a ratio of at least $\frac{1}{4}$ in. per foot. Ours runs to the lower terrace where the constant overflow is utilized in watering flowers.

Proper care in placing the fittings at the lowest point in the sump will assure complete drainage when the upright pipe is removed. The coupling should be placed so that its top rim will be slightly lower than the finished concrete surface. This is easily done by installing the lower drain pipe first, and either digging out or filling in to attain the proper level. No sealing compound should be used at this joint because it will have to be unscrewed each time the pool is drained. A return bend, connected to the top end of the overflow pipe, provides an automatic syphon and prevents any flotsam, small fish, etc., from clogging the drain. Thus it is possible to keep a tiny jet

of water flowing into the pool while maintaining a constant water level.

A richer mixture of concrete than the usual ratio is more satisfactory for underwater usage. One part of cement to two parts of sand and three of fine gravel will be very durable. One bag of mortar-mix added to this, however, will produce a smoother job and work easier. We used fine stone chips instead of gravel, and found it better for this work.

For large, thick-walled pools wooden forms must be used to hold the concrete in place while building, but for small and irregularly shaped ones the concrete can be applied without them, providing the mixture is not too wet. It will be necessary, however, to provide some way of holding the concrete up along the vertical portions of the pit. Most any available bits of woven wire, etc., may be used to advantage, or wooden pegs may be driven into the earthen walls and left exposed for an inch to hold the concrete in place.

After covering the entire area to the proper thickness, the surface should be well smoothed out. Dipping the trowel in water occasionally will assist in sealing the small holes and shaping the walls and bottom as desired. At this point it should be allowed to set. Any small cracks which might appear during this period can be sealed over by covering lightly with mortar-mix and water later on.

Several days will be required for the pool to harden, but it should be filled and emptied

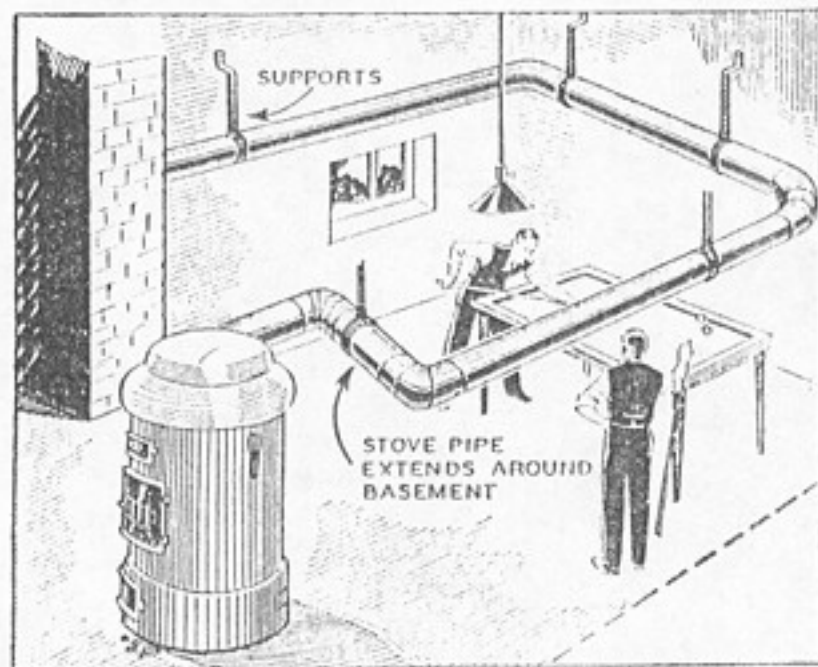
on the second day after pouring the concrete. By doing this several times on successive days the concrete will cure faster, and the free alkali (which kills fish) will be eliminated. Then, after thorough drying, a heavy coat of good enamel will seal the pores and beautify the pool.

Being fortunate in having a plentiful supply of flat rocks available in the mountains nearby, we selected large, well-weathered specimens for the outer rim and ledges of our pool, adding smaller ones as needed for the rock garden and laying them in natural manner with the grain running parallel. All that remained to be done after that was filling the pool and dropping in a few broken bits of concrete block, a supply of oxygenating plant weed, and some water flowers. Into this new piscatorial paradise we then put seven small fish.

Now, after three years, our goldfish population has increased some ten fold and we can sit out on the patio in comfort—forgetting the mosquitos which once plagued us. Except for a bit of weeding now and then, we have given the pool and rock garden practically no attention since originally planting the moss and small flowers.

Once built, there is nothing within the scope of the amateur gardener's capabilities which provide more real beauty, interest, and personal satisfaction—at so little cost or effort—than a well planned garden pool. •

Ideas That Save Time and Money



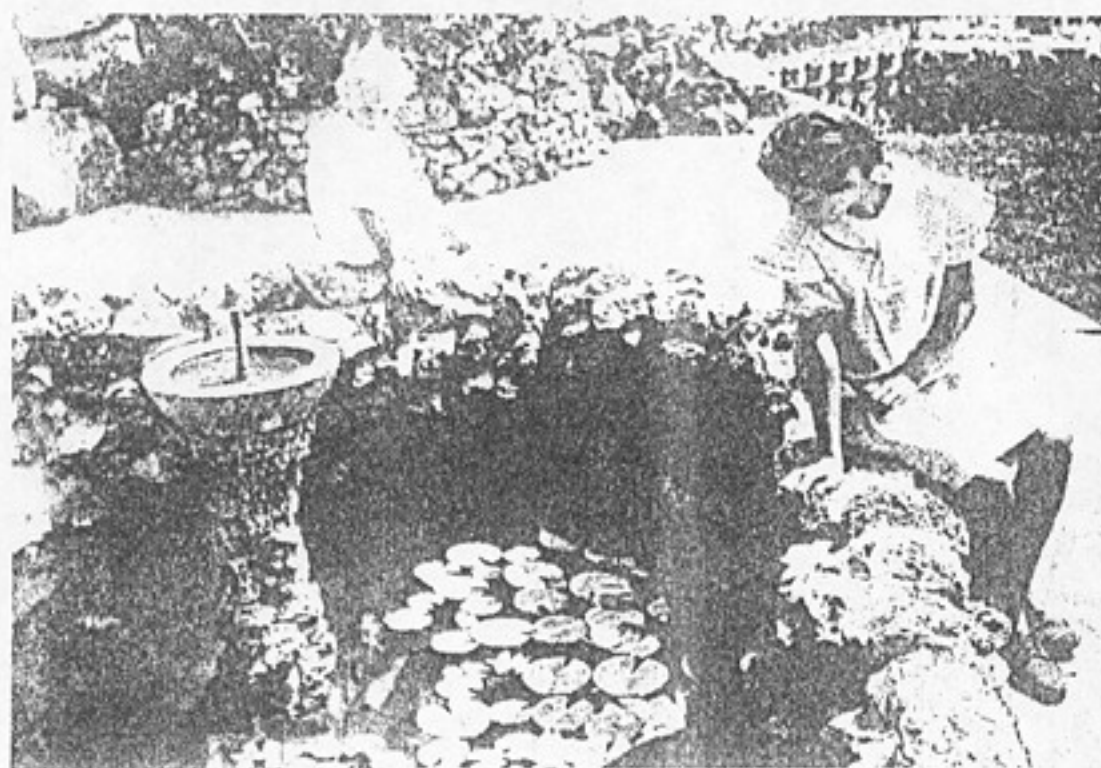
Heat Basement Without Fuel Cost

BASEMENTS can be heated without any additional fuel cost if the pipes leading from the furnace to the chimney are arranged around the room in the manner shown in the accompanying drawing. The pipes will be kept quite hot by heat which otherwise would be wasted up the chimney. The same idea can be extended to an ordinary coal stove to obtain the greatest amount of heat from a minimum of fuel. In effect, the pipes, which are of course uninsulated, act as radiators. A garage can be similarly heated.

—Wil-
liam
Tatina.

MODERN MECHANIX, 1934

Rock Gardens, Pools



A high wall around this pool, and a stone fountain in the center make it attractive. Lily pools are expensive if professionally built, but a few hours leisure time and some elbow grease are all you'll need to make one of these charming additions to the garden yourself.

professional workers have found that an irregularly shaped pool looks far better than one of more regular dimensions. One effective design is shown in the overhead view, (drawing Fig. 6) with a waterfall built up in the middle. As will be seen on examination of this drawing, the rock garden part of this item is somewhat semicircular

by Paul Hadley

Mechanix Illustrated June, 1939

ROCK gardens, with their attendant lily pools, have been getting increasingly popular for the last few years, and rightly, for there are few units in a well-landscaped lawn that add as much in appearance as a well done rock garden. These decorations are expensive however, when done by a commercial nursery or landscaping concern. There is little about the making of either a rock garden or lily pool that cannot be done by the average home owner, who has a little time on his hands, combined with a small amount of artistic and mechanical ability. The accompanying photos and drawings of garden pools and their ornaments show but a few of the designs that can be easily worked up by the home craftsman.

Of course, the first thing to be decided upon is the location and size of your project. As to location, any well-drained place is suitable, and the size will have to be governed by the amount of space you have available. Most rock gardens contain lily pools, though lily pools by no means always have their attendant rock gardens, and one will naturally locate his pool in a place convenient to water supply pipes, also drains by which the pool may be emptied into the sewer occasionally. Your plumber, of course, will be the best one to consult about this matter.

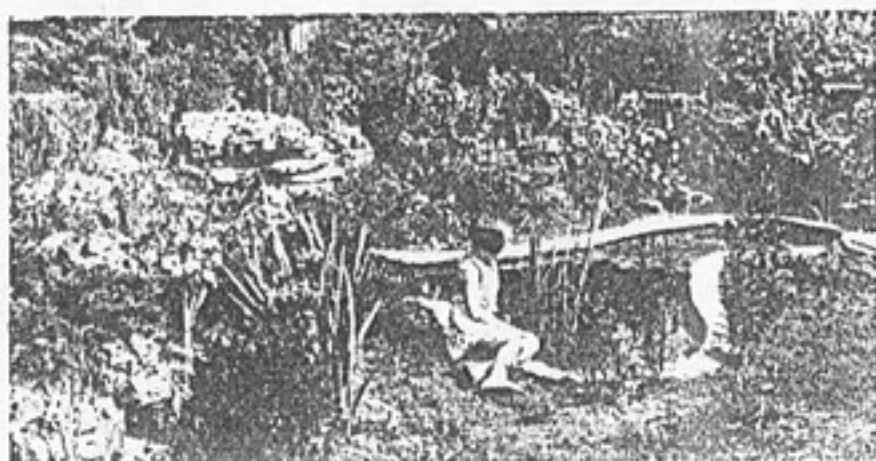
In laying off the shape of the lily pool,

in shape, with the pool between the "arms." In selecting rocks for your garden and pool, the rougher and more uneven in size and shape you can get them the better—rocky hill-sides are good places to look for them, but if these are not convenient, you may have to purchase your rock from a commercial concern.



This windmill is an excellent lily pool ornament, and is easily made from wood and galvanized iron. (See drawing.)

and Ornaments



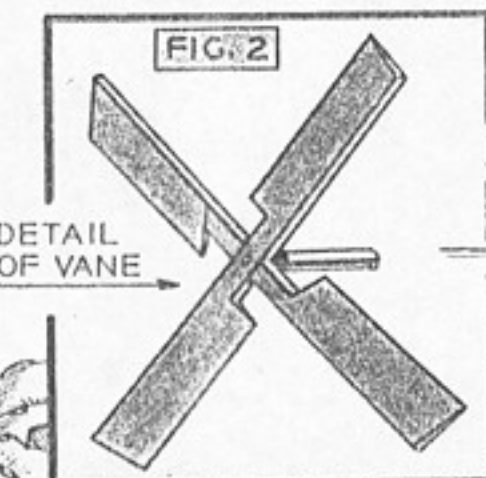
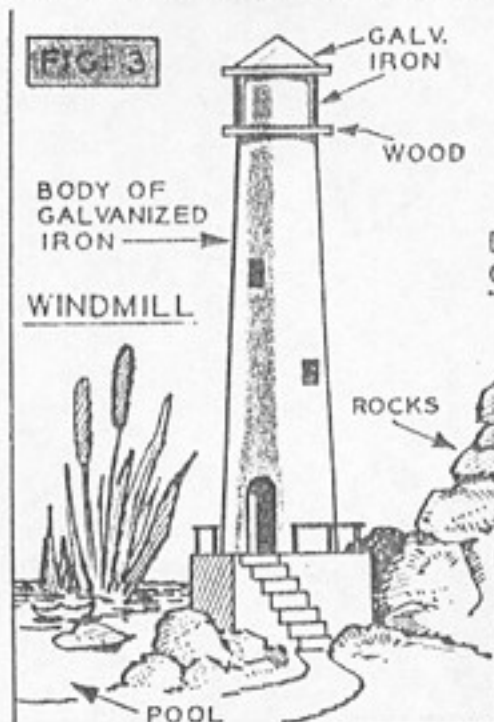
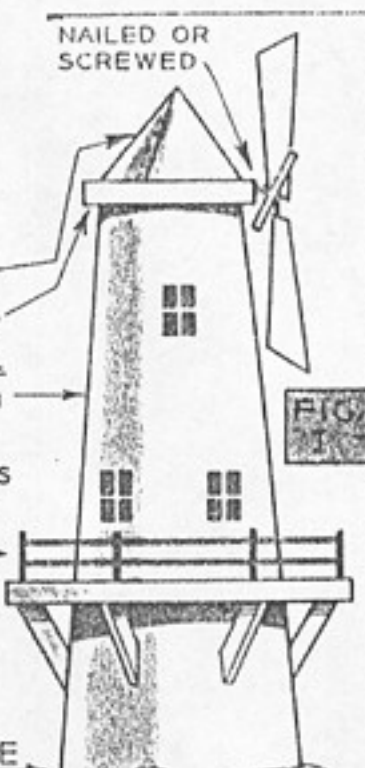
An irregular pool is decorative and blends with the garden.

GALVANIZED IRON

WOODEN TOP

BODY OF MILL OF GALVANIZED IRON

PLATFORM, POSTS AND BRACES OF WOOD, STRIPS OF TIN FOR RAILINGS



LIGHTHOUSE

ROCK BASE



CONCRETE

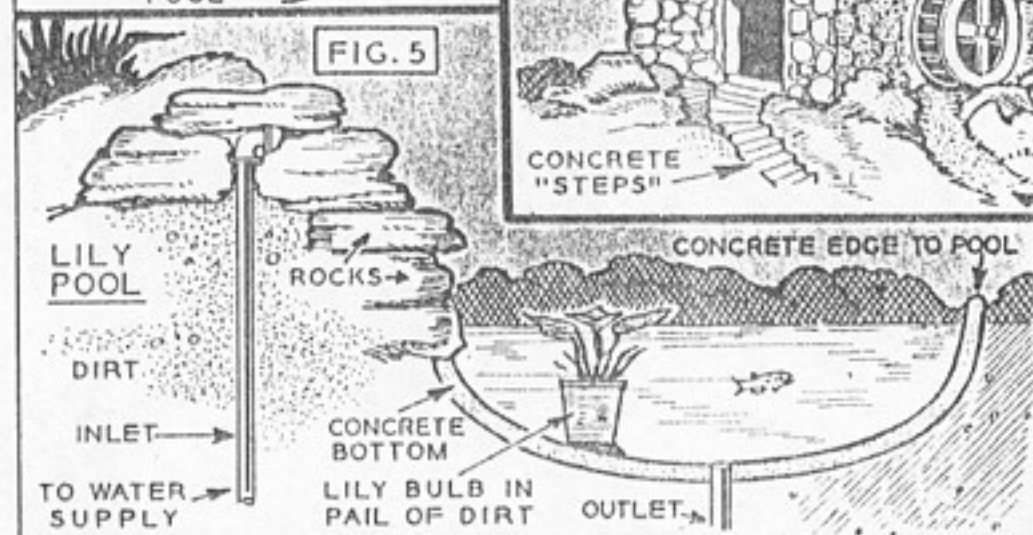
WATER INLET HIDDEN UNDER ROCKS

SLUICE

POOL

TO WATER SUPPLY

CONCRETE SPILLWAY



LILY POOL

ROCKS

DIRT

INLET

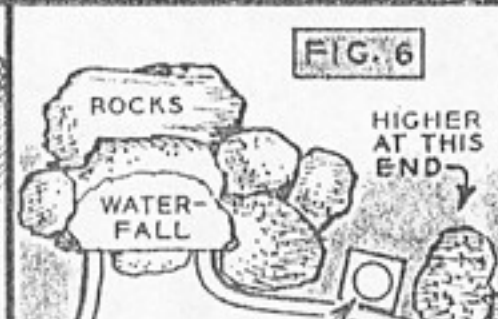
TO WATER SUPPLY

CONCRETE BOTTOM

LILY BULB IN PAIL OF DIRT

OUTLET

CONCRETE EDGE TO POOL



ROCKS

WATER FALL

HIGHER AT THIS END

LIGHTHOUSE

POOL

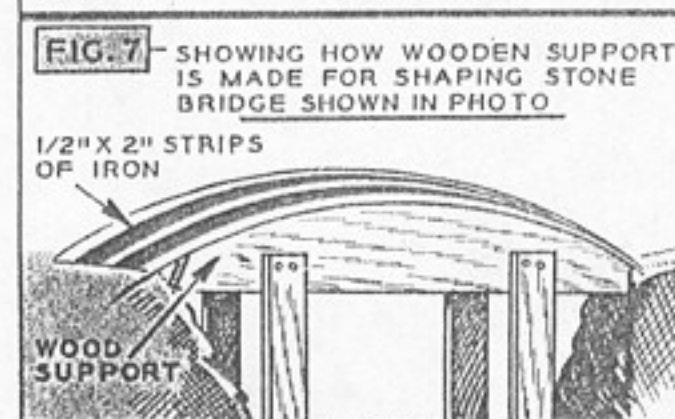
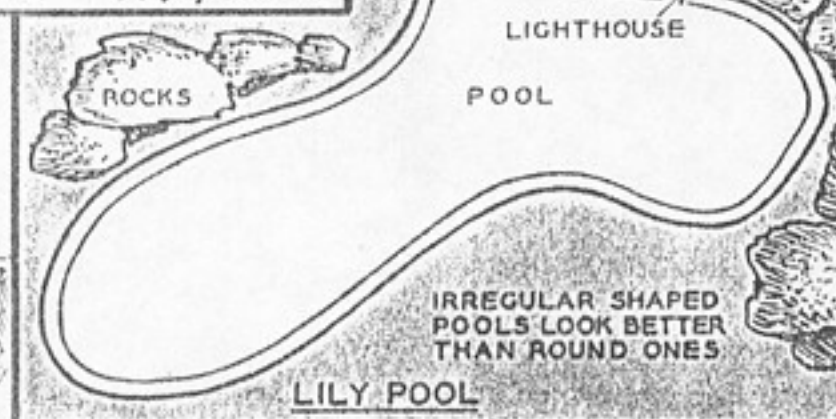


FIG. 7 - SHOWING HOW WOODEN SUPPORT IS MADE FOR SHAPING STONE BRIDGE SHOWN IN PHOTO

1/2" X 2" STRIPS OF IRON

WOOD SUPPORT

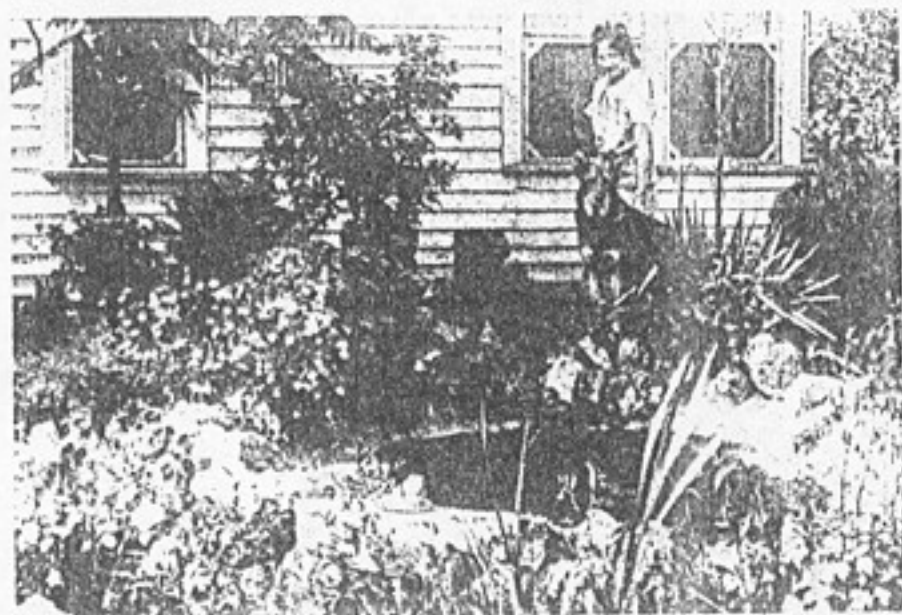


IRREGULAR SHAPED POOLS LOOK BETTER THAN ROUND ONES

LILY POOL



Stone bridges across garden pools lend an easily rendered artistic touch. A bridge like that above is cast in concrete on a form, which is subsequently removed. If desired, span can be braced with strip iron.



A pool for grounds of limited space. Rock garden surrounds pool, and spaces between the rocks are filled with rich earth, then set with a variety of plants. Water cascades from the high rocks at one side.



A rock garden and pool suitably designed for a larger plot. The flag stones can be made by digging irregularly shaped holes in the ground, about three inches deep, and filling with a rich cement mixture.

After you have laid out the shape of your pool, dig the earth out to a depth of about two feet, piling it up in a mound on the side of the pool where you intend to set the rocks. Remember that the rocks in a rock garden are set with generous spaces between them, which are filled with earth, and set with plants and shrubs. Before concreting the inside of your pool, be sure to have pipe connections made with the water supply and the drain, otherwise you will have difficulty getting them in later. Fig. 5 shows a sectional view of such a pool. The rocks, at the right are loosely set, with the water supply pipe rising between them to the top, where the water flows from the invisible pipe to form a miniature waterfall. The drain pipe in the center of the pool's bottom should be covered with wire mesh, and lead to some outlet for emptying the pool.

Ornaments, such as windmills, lighthouses, mills, etc., add greatly to the appearance of any lily pool, and these are more easily made than one might think from their extremely decorative appearance. Windmills, of stone, sheet metal, or even wood, are very popular, and one of these (Fig. 1), can be made in a short time from wood and a few scraps of galvanized iron. As the mill and other ornaments herein described will differ in size with the size of your pool, no attempt is made to give dimensions. The body of the windmill, from the rock base to the top, is made of a single piece of galvanized iron, riveted together, and with the windows and door cut through before riveting. The ringlike platform, about a third of the way from the base, is made of wood, as are the supports by which it is bolted to the iron. Post, of wood, and railings of narrow strips of the iron, add to the realistic appearance. The wooden disc at the top serves as something to fasten the mill sails to (Fig. 2) and is fastened to the iron with small screws. The cone shaped top is also fastened in this manner. The sail, or vane (Fig. 2), is of ordinary construction, and is made to turn in the wind.

Fig. 3 shows a diminutive lighthouse of similar construction, sitting on a base of concrete. The top, which is removable, is fitted with a five-watt bulb, in a socket which is connected to the electric supply so the lighthouse can be made to light in realistic manner. Construction of the base is easily done, by making a small wooden frame in square shape, filling with concrete, then setting the galvanized iron "tower" in place before it hardens. Of course, you must make your electrical connections before this is done, leading the wires preferably down through the base inside a metal pipe-or conduit.

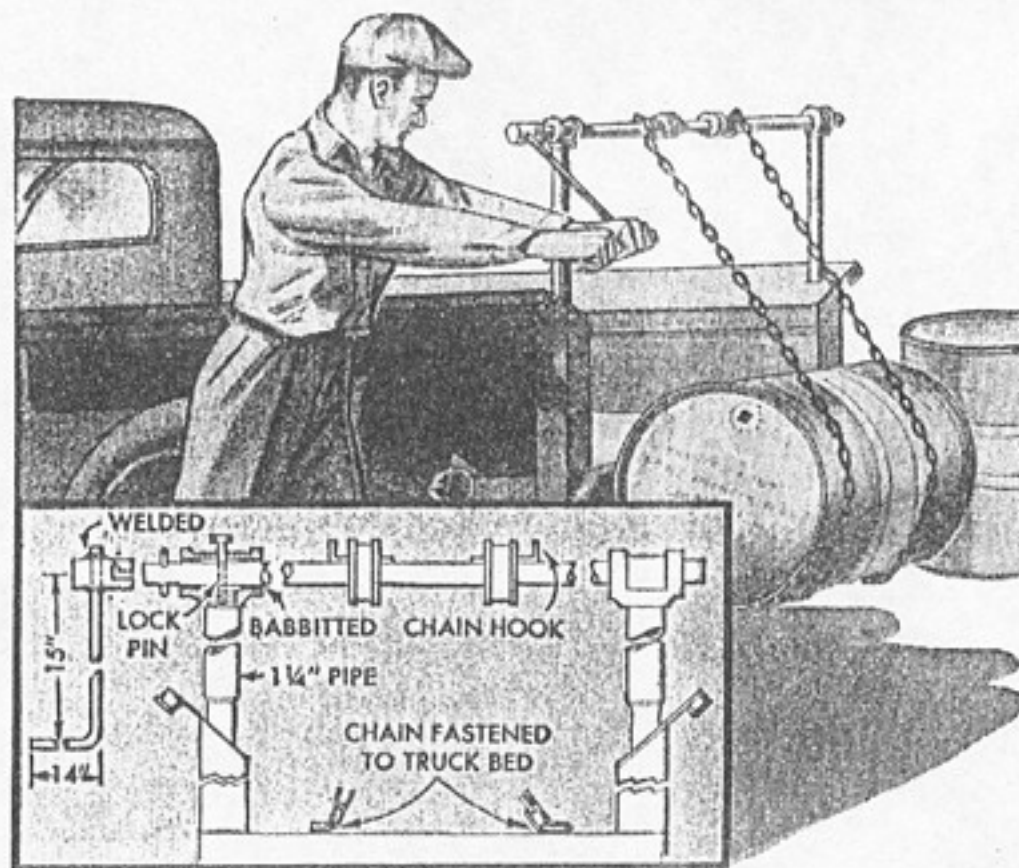
The little water mill, shown in Fig. 4, is decidedly decorative, and with the exception of the wheel, which actually turns when the water runs over it, is entirely of small stones set together with mortar, and a roof of imitation shingles. Little description of this ornament is necessary, as the picture speaks for itself. The wheel can be made of sheet metal by your tinsmith, or by yourself, and should be well balanced. It is fitted with cross "paddles" about two inches apart on a wheel of say, 10-in. diameter. The wheel should be mounted on a shaft, which in turn is set into the wall of the mill. The "millrace," (the trough which leads the water to the top of the wheel from the water

supply), is of metal or wood, and the stream is led to this from the water supply in a concrete trough. A second trough at the bottom of the wheel, leads the water into the pool, after it has dripped from the wheel.

Many other variations of these gardens and their ornaments can be devised. For instance, a small stone bridge can be made by laying stones in concrete mortar over a carved wooden support. After the concrete has set, the support can be knocked out from underneath, leaving the bridge clear. For added strength, a couple of strips of heavy strap iron, $\frac{1}{2}$ -in. thick, can be laid over the support before the concrete is applied, making a bridge which will bear considerable weight. A concrete birdhouse, upon a laid up rock pillar is another attractive idea. The four small pillars, supporting the house itself, are made by filling quart fruit jars with concrete, then breaking the glass away after the concrete has hardened.

Lily pools must contain lilies, and these are best set out in buckets of mud, and then submerged in the pool. There are many other water loving plants, and suitable shrubs for rock gardens can be easily procured from any nursery or plant dealer.

One Man Can Lift Oil Drum With This Hoist



With this hoist attached to the rear of a truck, one man can load and unload oil drums with a minimum of effort, and since it isn't necessary to come in contact with the drum, clothes are kept cleaner. Pipe is used for the up-rights with one end squared to fit into the stake sockets. Babbitted pipe tees serve as bearings for the shaft which has two set collars with hooks to anchor the chain. One bearing and the shaft are drilled for a lock pin. The crank is detachable so that it can be carried in the truck cab when not in use. One end of each chain is fastened to the truck bed. To load a drum, place it on the chains after the hoist has been unwound and turn the crank until the drum rolls on to the truck. The procedure is reversed for unloading.

Walter P. Fuchs, Evansville, Ind.

A Miniature Japanese Garden

ANY small, neglected nook in your back yard can easily be transformed into this attractive miniature Japanese garden, with its high-arched bridge, charming stone lamp, fish pond, and cottage. In old Japan, where every inch of land is utilized, you will find these carefully planned gardens everywhere.

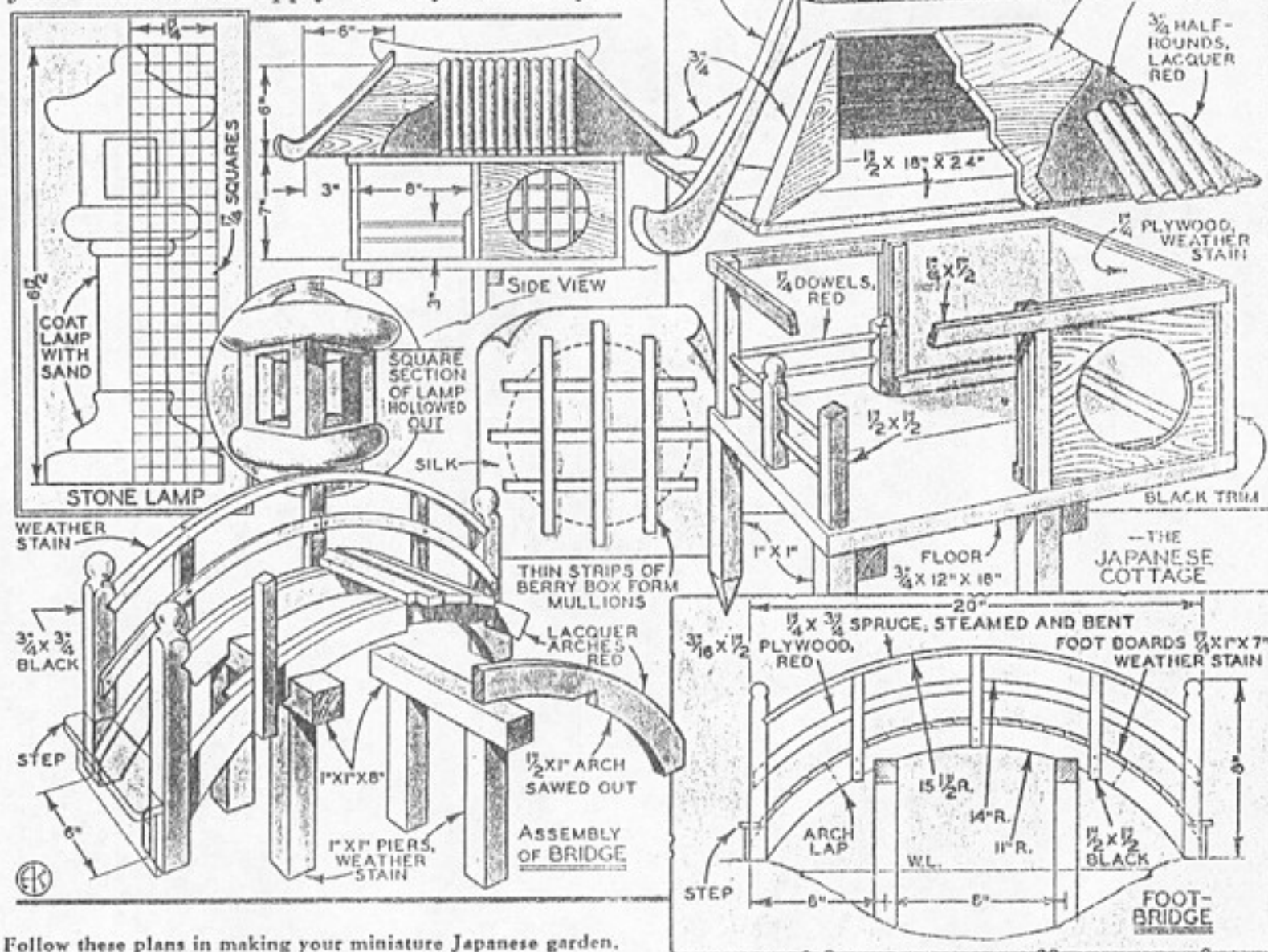
Windows of the cottage are criss-crossed with narrow strips of berry-box wood, over which is tacked a square of white silk, to create the effect of the paper *shoji* of Nippon.

The bridge rails are steamed, then bent to shape and allowed to set before assembling with the other pieces. Red lacquer, touched up with black and gold, is an effective color scheme. The last coat should be a clear shellac, applied to all parts of the bridge.

Turn out the wood lamp on a lathe, carve out the lamp holder, apply gray paint or lacquer, a coat of marine glue, and finally sprinkle sand all over to give the stone effect.

Arrange moss, rocks, and dwarf plants around the pool and cottage. Run pipes from your home water supply to a tiny fountain just

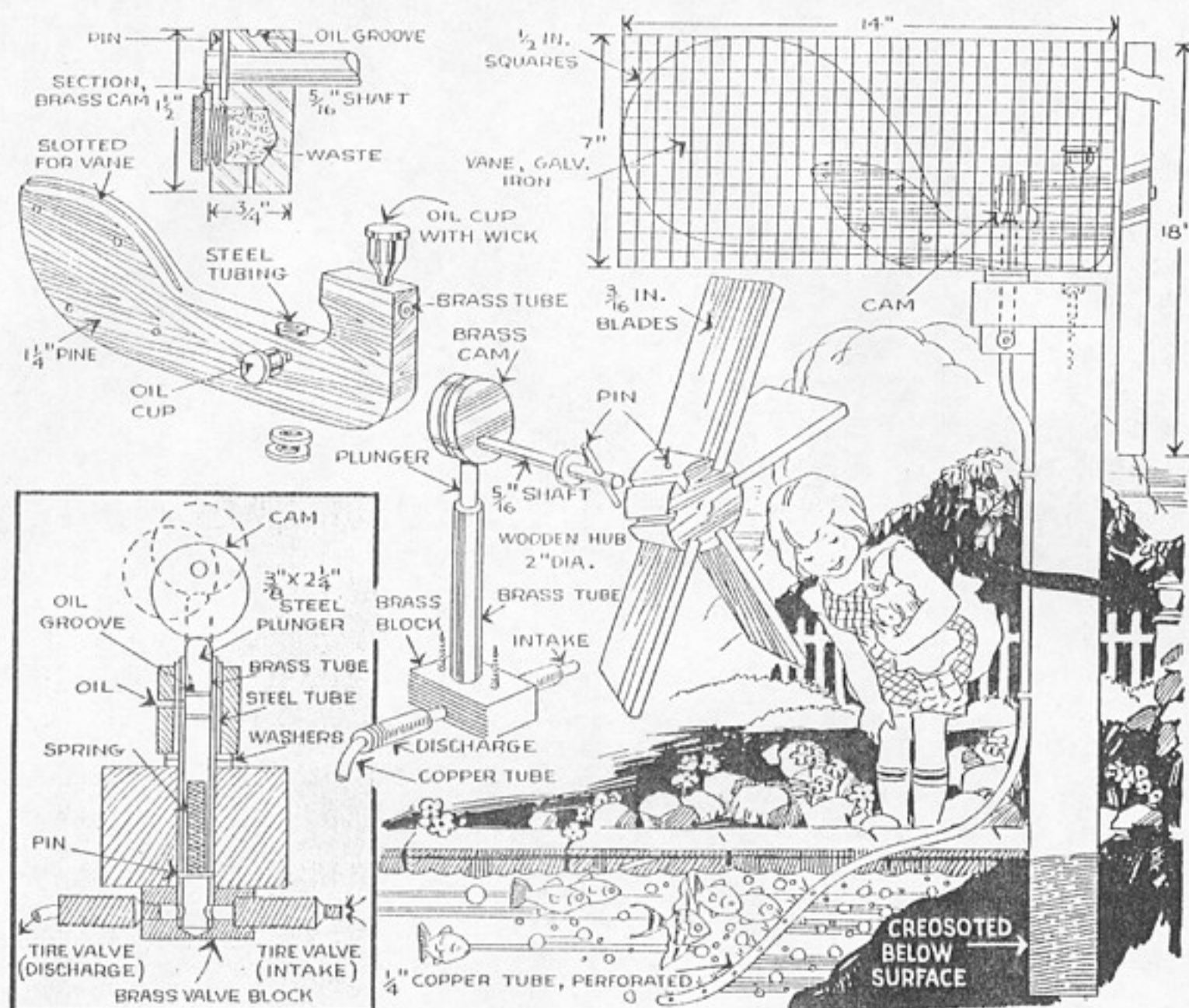
above a little rock waterfall, from which water can cascade down into the pool below. Your own ingenuity is the only limit to the possibilities of this garden.

MODERN MECHANIX *July, 1935*

Follow these plans in making your miniature Japanese garden.

Popular Mechanics June 1938

Windmill Pump Aerates Outdoor Fish Pool



Aerating outdoor fish pools is a simple matter with this windmill-driven pump. As long as there is any wind, the pump produces a constant supply of air, which is liberated under water. A wheel of 18 in. or more in diameter rotates a cam, which actuates the pump plunger or piston. The wheel is pinned through the hub to a steel shaft on the other end of which is a brass-disk cam also pinned to the shaft. If you care to go to the extra work, an oil pocket can be bored and fitted with a cap, and an oil groove turned in the periphery, as shown. The groove should be very shallow, and a small oil hole should be drilled in it to the pocket which is packed with oil-soaked cotton. The shaft is mounted on a wood bracket, and turns in a brass-tube bearing. The bracket swivels on another brass tube which serves as the pump cylinder. A steel sleeve over the brass

tube forms a bearing. The pump plunger is of steel with the upper end ground convex where it contacts the cam. A coil compression spring keeps the plunger against the cam. Ordinary tire valves are screwed into a brass block at the base of the pump cylinder, arranged so that the air can come in one and pass out the other. An oil cup with wick should lubricate the plunger. This is important, as it will also increase the efficiency of the pump. A 1/4-in. copper tube is soldered or connected to the discharge valve and carried down under the water of the pool. A number of very small holes, none over 1/16 in., are drilled in it, and the end is plugged with solder or pinched in a vise. If small ball-thrust bearings are available, operation will be greatly improved by installing them behind the windmill and on pump cylinder between the bracket and the top of post.

CIRCUS WAGON

With Animal Cutouts

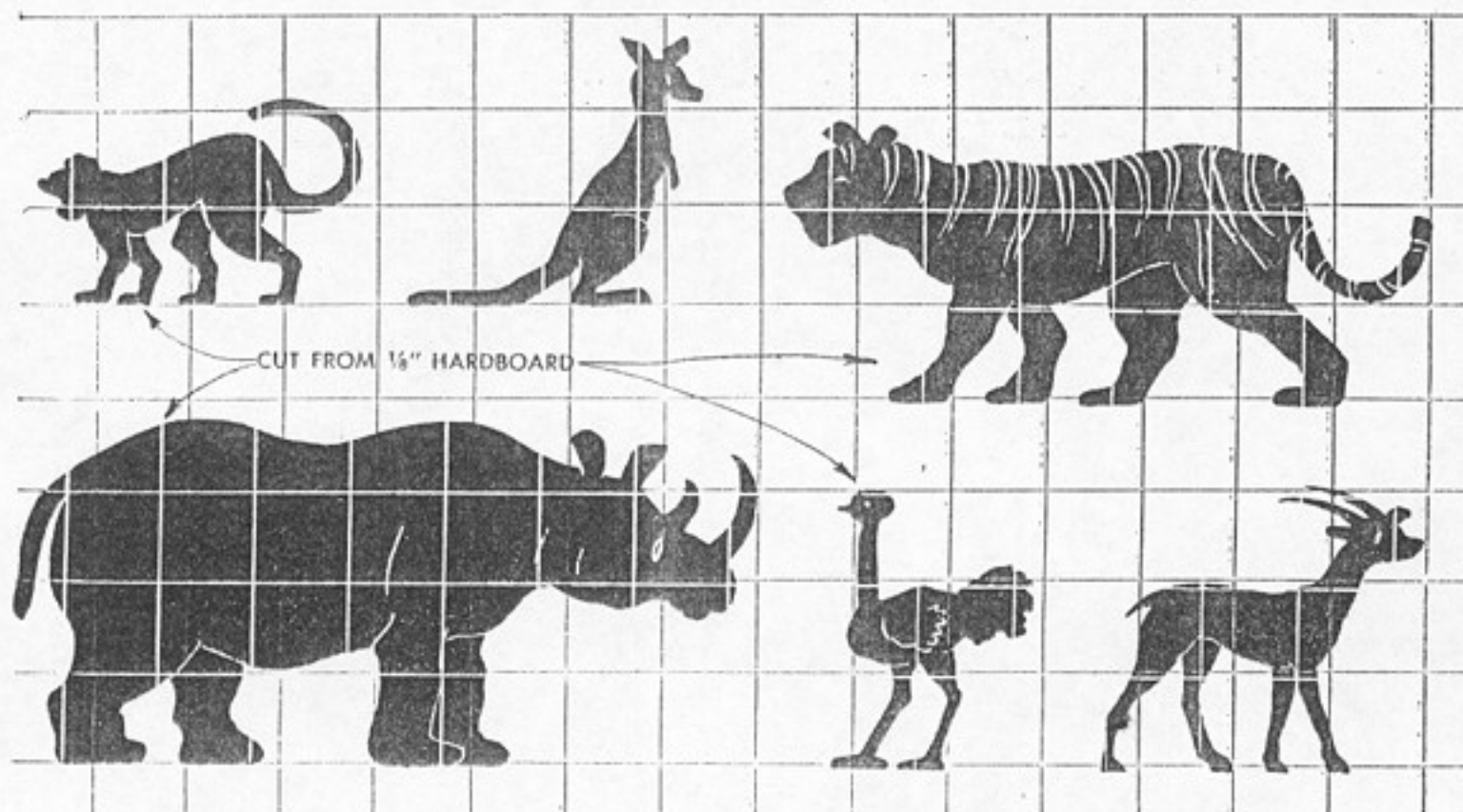
By Hi Sibley

PRANCING HORSES and wild animals interest almost any child, and when they are combined with a gaily colored circus wagon, the result is an exciting toy that will provide hours of playtime fun for any youngster who receives it. Simplicity of construction is the feature that will be appreciated by the builder of the wagon, as it requires only a couple of feet of stock lumber, some $\frac{1}{8}$ -in. hardboard and a few short dowels. The top and bottom of the wagon are drilled in one operation, assuring alignment of the holes for the cage bars. If perfectly round wheels are desired and no wood-turning lathe is available, cut $\frac{1}{4}$ -in. slices from a $2\frac{1}{2}$ -in.-dia. dowel instead of using $\frac{1}{4}$ -in. plywood as suggested. The ornamental side pieces of the wagon are jigsawed in pairs or, if a number of wagons are to be made, can be "mass produced" by sawing a stack of pieces at one time. The horses, wild animals and the driver are jigsawed from $\frac{1}{8}$ -in. hardboard. The driver is cemented in position on top of the wagon. To support animals and horses in a vertical position, cut bases of $\frac{1}{8}$ -in. hardboard and cement to their feet.



Popular Mechanics 1958

Bases for the animals must be narrow enough to permit them to be inserted in the back of the cage. To save time in making the animals, pictures can be cut from a child's animal book or from magazines and cemented to hardboard, then jigsawed to shape. Paint the side pieces of the wagon blue with gold decorations. The front of the wagon is red, the cage bars are black and the floor is gray. Horses are cream colored and have red harnesses and plumes. Horses are held in harness by drilling holes through the belly bands so they can be slipped over the dowels in wagon tongues. Enlarge animals to suit wagon. ★ ★ ★



Blockmobiles

by Willard Waltner

POPULAR MECHANICS

NOVEMBER 1973

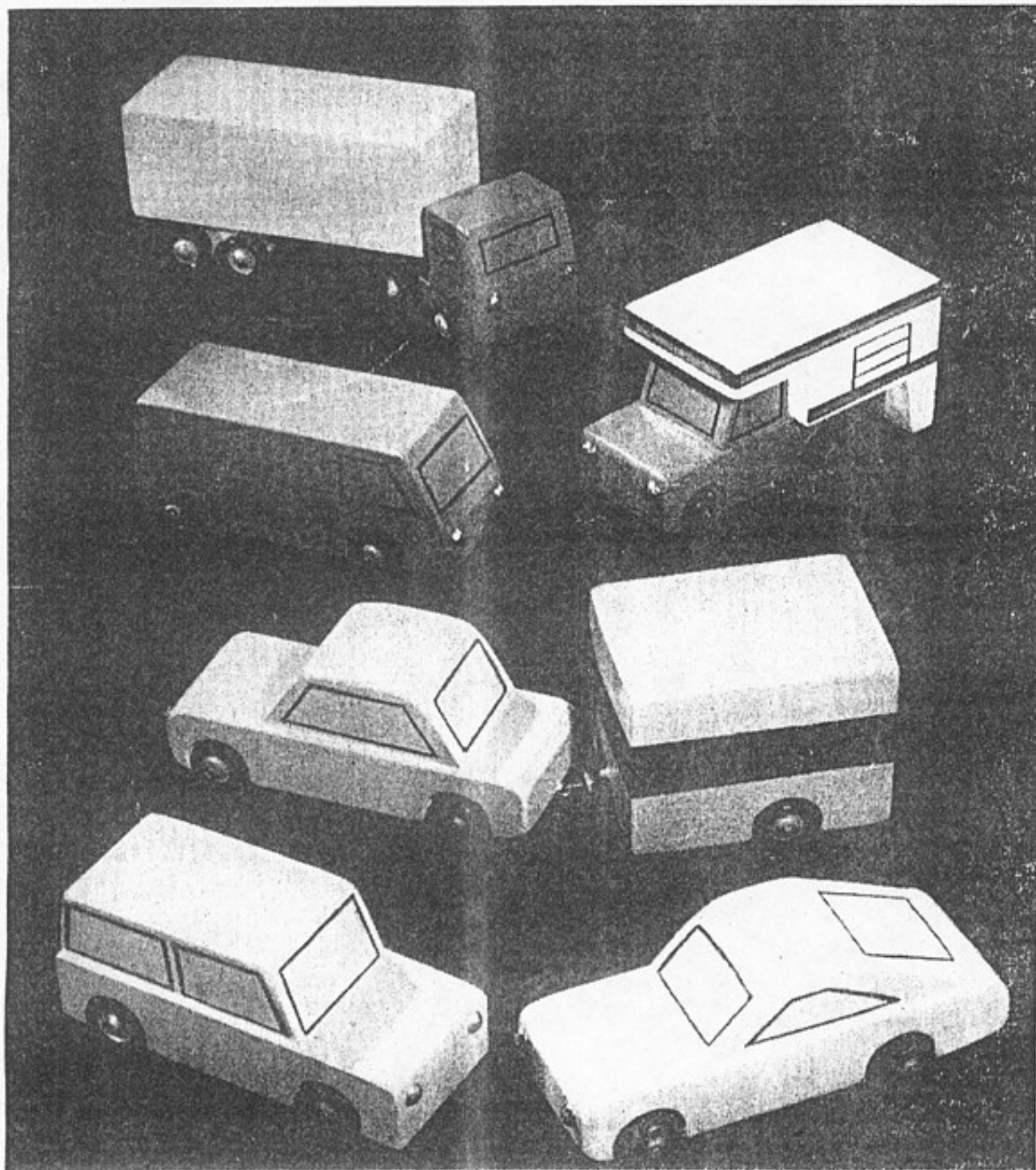
Christmas gifts
you can make

A fleet of these classy blockmobiles will provide hours of fun for a 4-year-old, and they can be made for practically nothing from scraps of $\frac{3}{4}$ and $1\frac{1}{2}$ -in. pine found in your woodbox. They are also practically unbreakable.

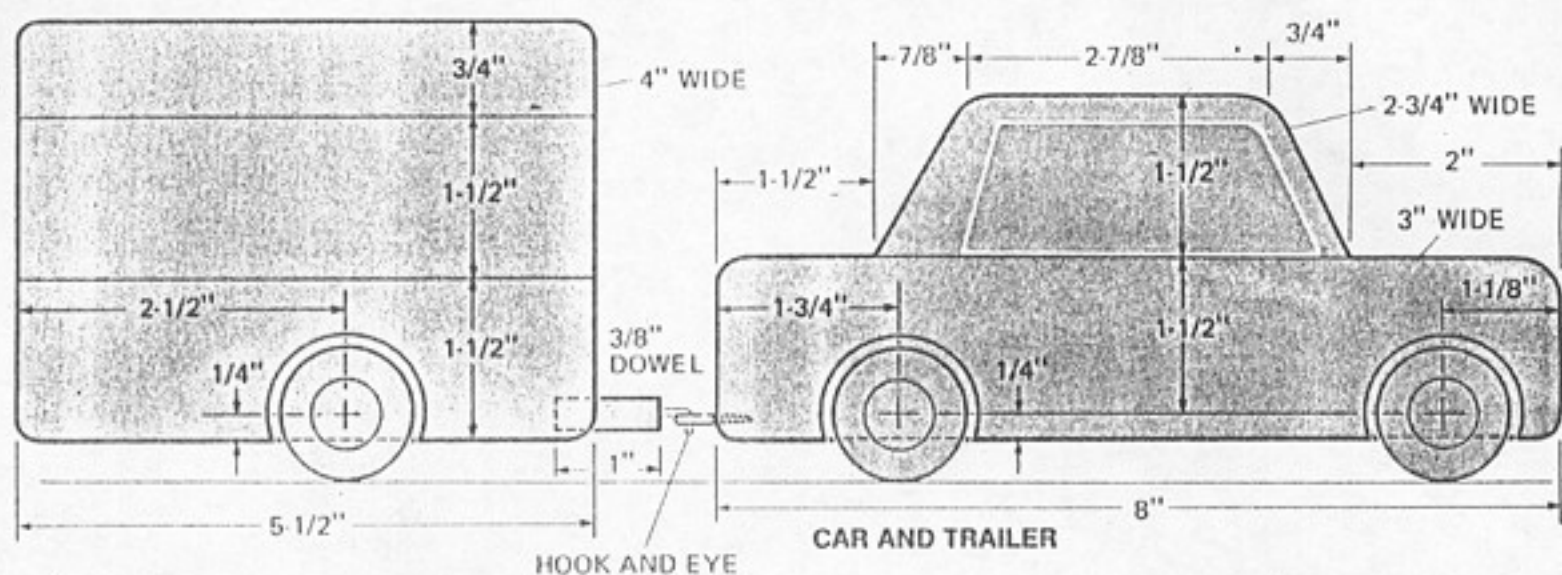
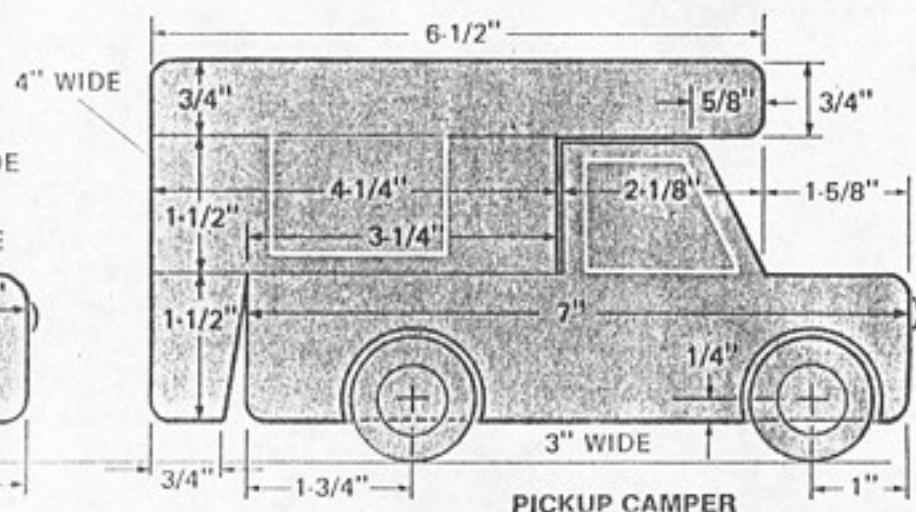
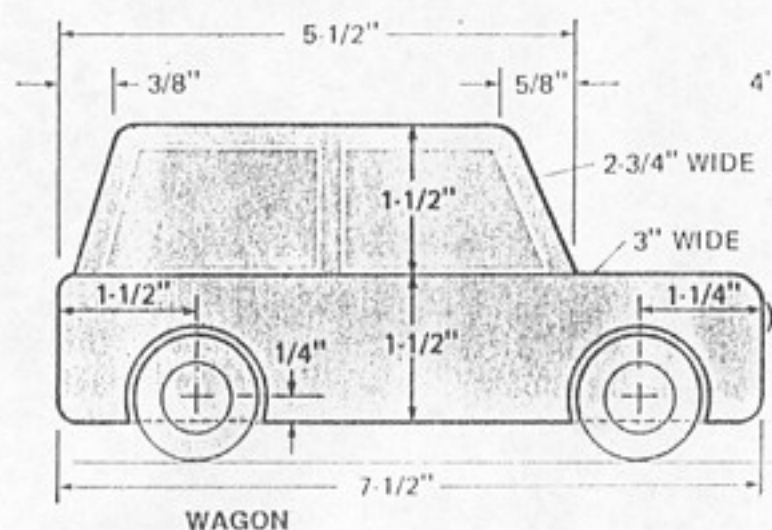
All are made by first gluing up blocks of

varying thicknesses after precutting them to shape. All fender "wells" are bored $\frac{1}{2}$ in. deep with a $1\frac{3}{8}$ -in. spade power bit. Then $\frac{5}{16}$ -in. holes are drilled from each side for free-turning axles of $\frac{1}{4}$ -in. dowel rod.

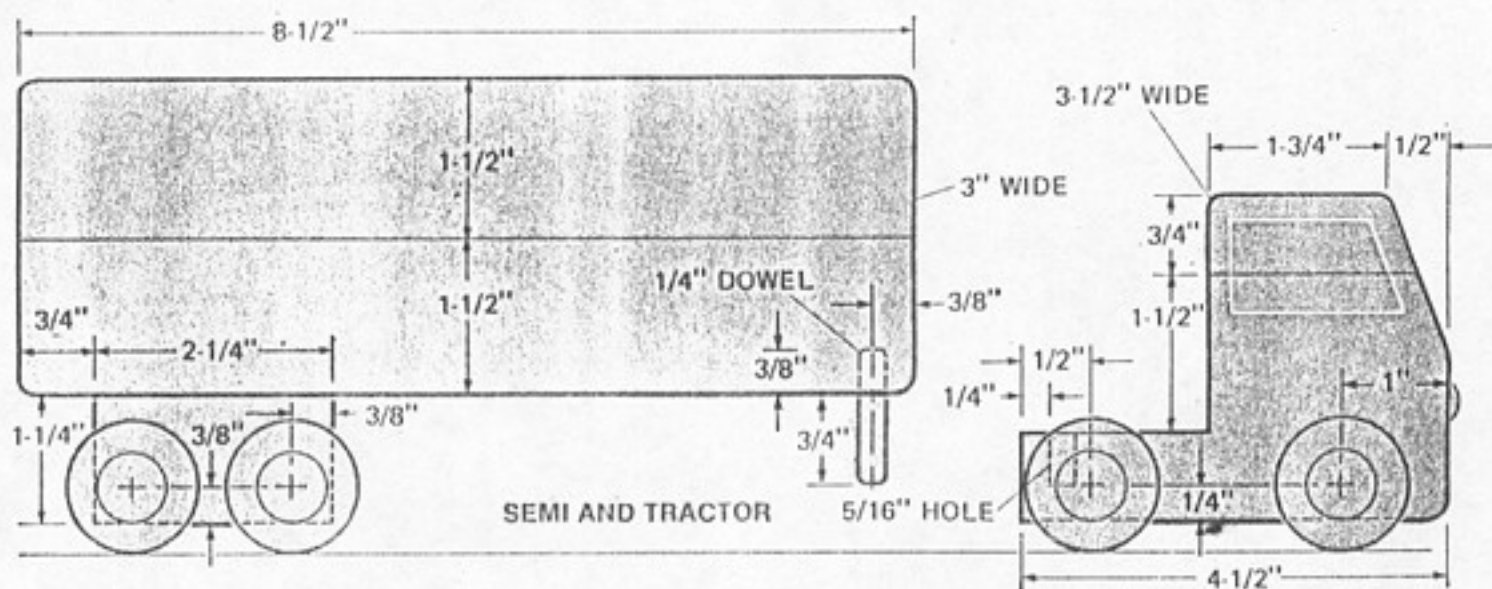
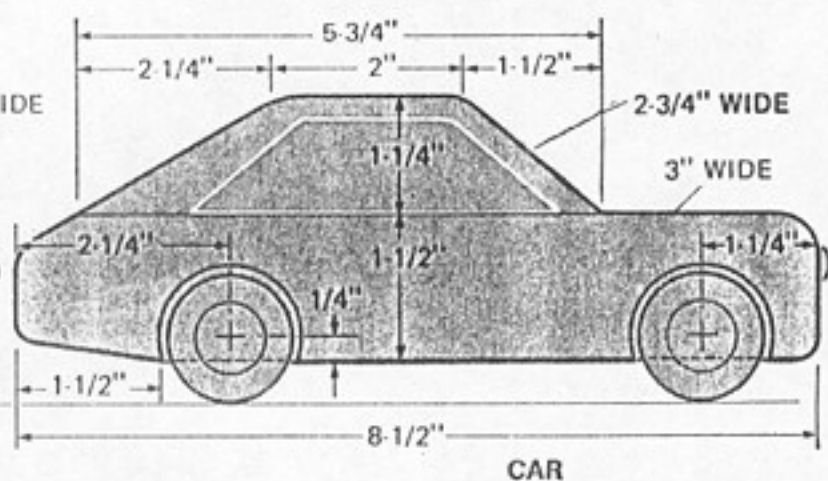
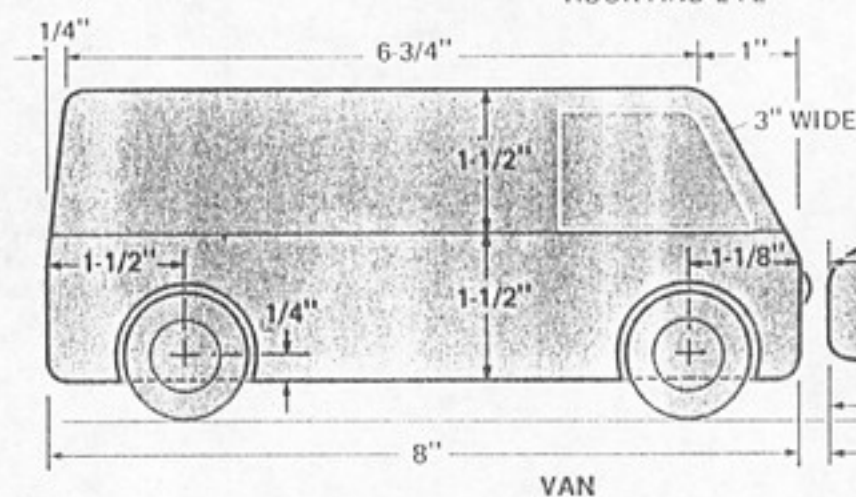
The wheels are easy to make if you own

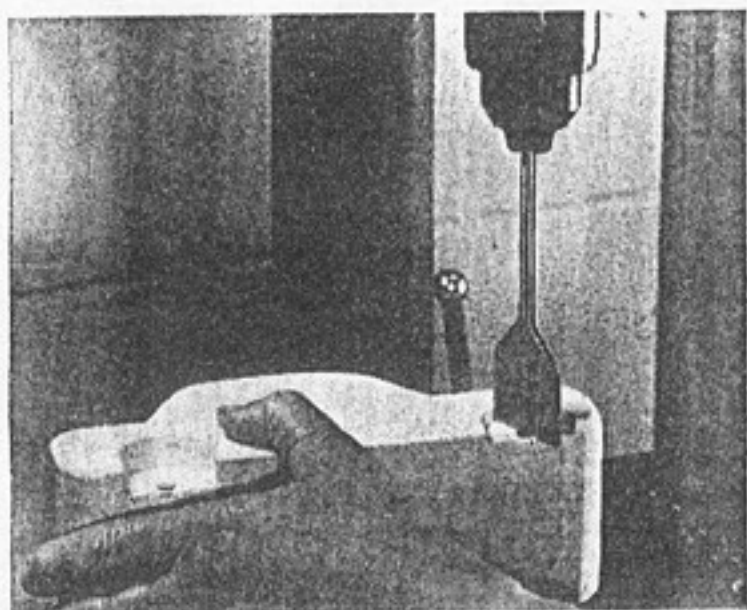


Fun fleet for toddlers

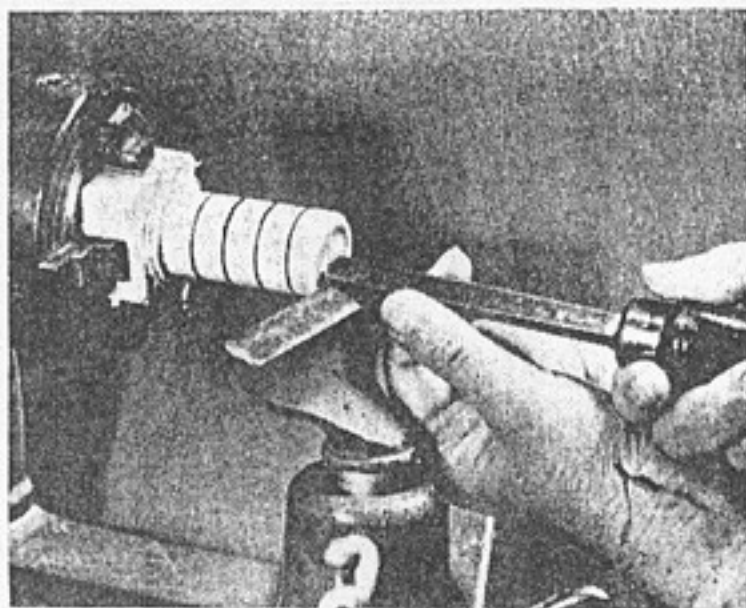


HOOK AND EYE

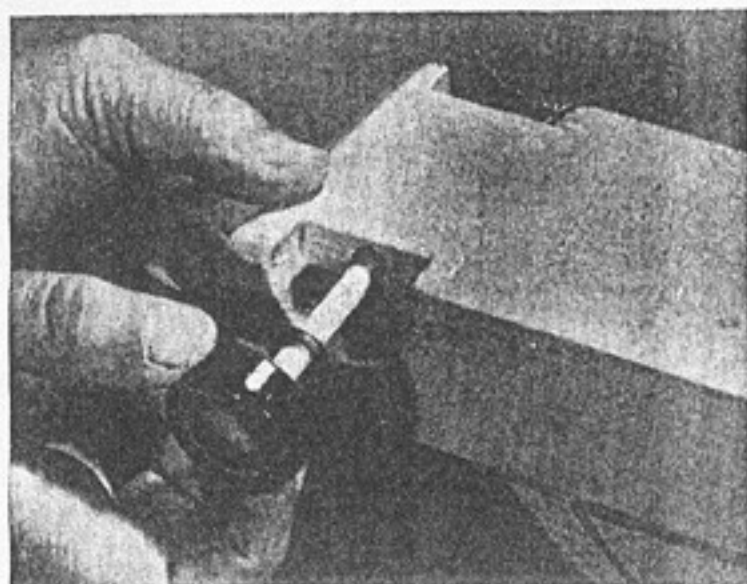




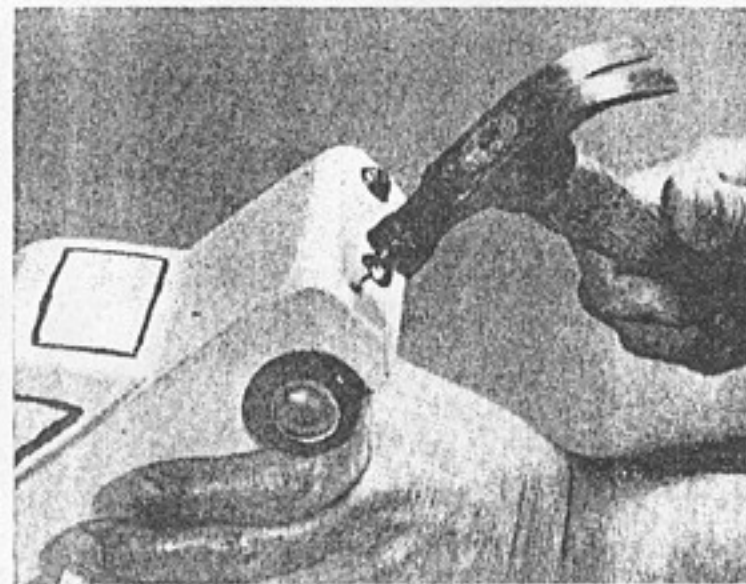
Fender wells for wheels are made $\frac{1}{2}$ in. deep with $1\frac{3}{8}$ -in. spade-type bit chucked in drill press.



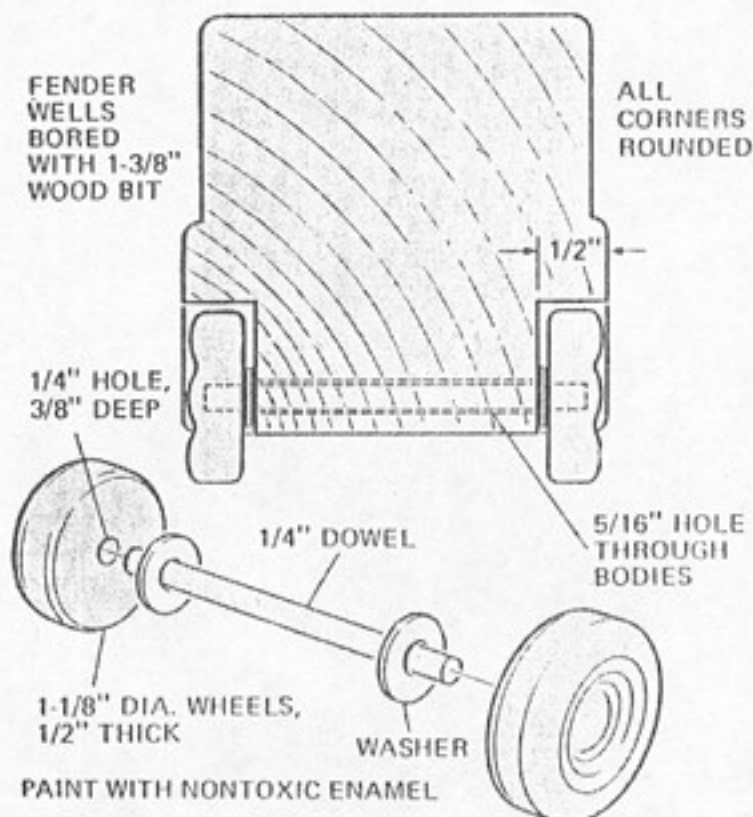
Wheels are turned one at a time from chucked turning. Shape hub and tire first, then cut off.



Glue wheels to dowel axles after inserting axles in their holes and slipping washers over the ends.



Fancy-head upholstery nails make perfect headlights. Wooden screw-hole buttons, painted, can also be used.



a lathe, but there are other ways to make them. One way is with a hole cutter in a drill press; another is with a pivot jig clamped to the table of a disc sander. In a pinch, checkers could be used for wheels.

The best way to turn the wheels is to gang-turn them from a single turning as shown in the photo above. Here the wheels are cut off one by one after you form a hub on the face of the wheels and round the edges to form a tire. The wheels are glued onto the ends of the dowel axles after being drilled $\frac{3}{8}$ in. deep from the inside. Washers keep the wheels from rubbing and sticking. It's best to paint the wheels beforehand.

It's important, of course, to round all sharp edges, sand the wood smooth and paint the vehicles with a nontoxic paint.

Upholstery tacks are used for headlights, and a small L-hook and screw eye are used as a hitch for the car and trailer. ★ ★ ★

Gold Still Lures Prospectors

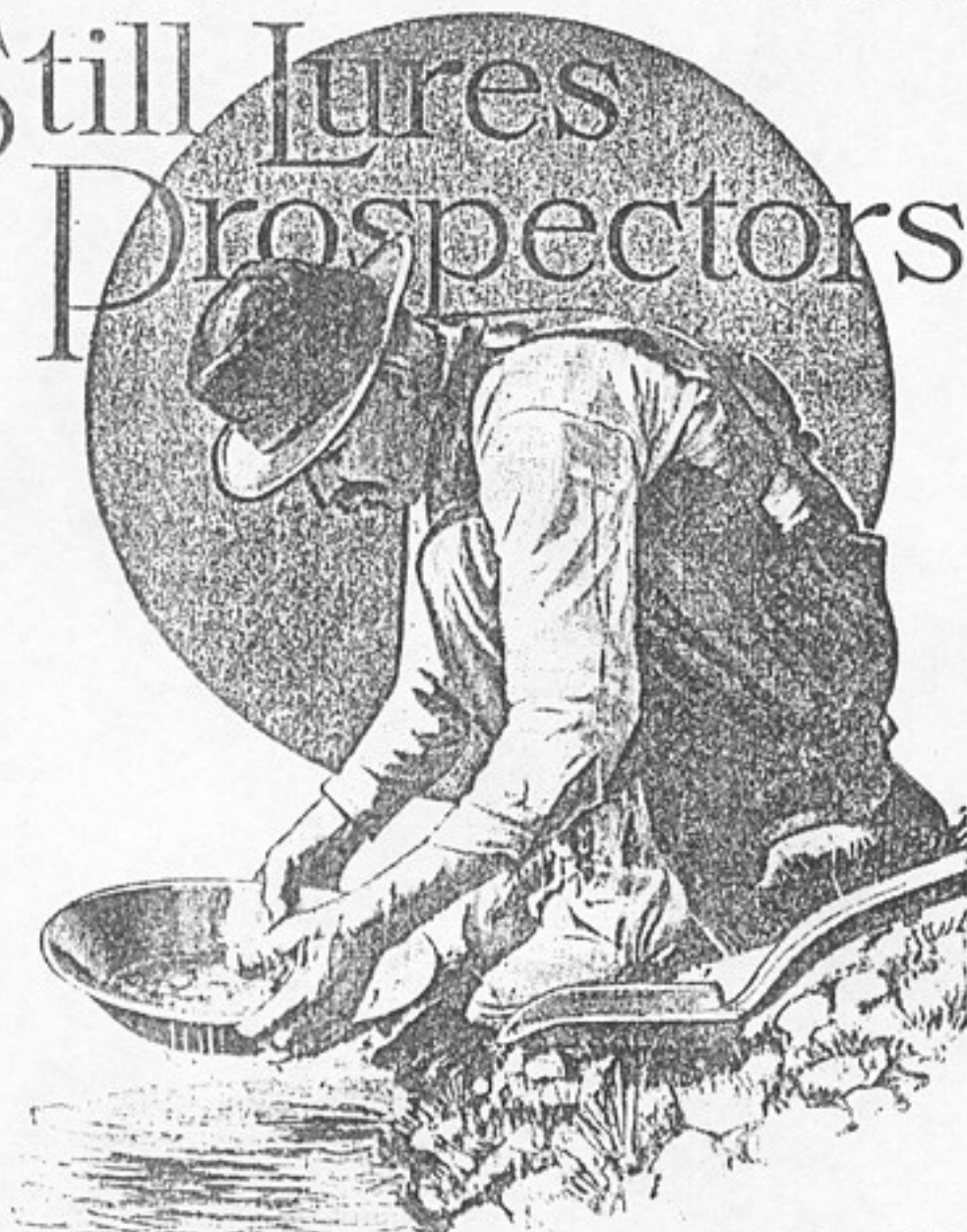
THREE years ago a mining engineer took a short cut through the Nevada hills. Using old trails and foot-paths, he traveled 150 miles without seeing a soul. A few months ago he made the same trip. This time he found prospectors at every turn. Nearly a thousand were camped in the washes and hills, panning the gravels and chipping at outcroppings.

It is estimated that in California alone, 10,000 people are looking for gold. Some are old prospectors, but most of them are making their first trips. Everywhere the search for gold has started again.

Has all the gold in the United States been discovered? Mining men do not think so. They point out that some of the richest finds have been made in districts that have been prospected for years. The 1927 gold strike at Weepah, Nev., was made on ground that had been worked over for forty years. Deposits of other precious metals are sometimes overlooked, too. Years ago a railroad was built to the Randsburg mining district in California. One cut through a hill exposed a rich vein of tungsten ore that was more valuable than most gold ores. But it was a long time before some curious individual chipped off a specimen and had it assayed.

The fabulously rich Kelly-Rand silver mine was found only after hundreds of miners had worn a smooth path across the outcropping, walking between a boarding house and another mine. For years the ore was only a place where miners stubbed their toes.

Not only do engineers think that new gold deposits will be found, but they say valuable discoveries may be made very soon, perhaps this year. They recall that



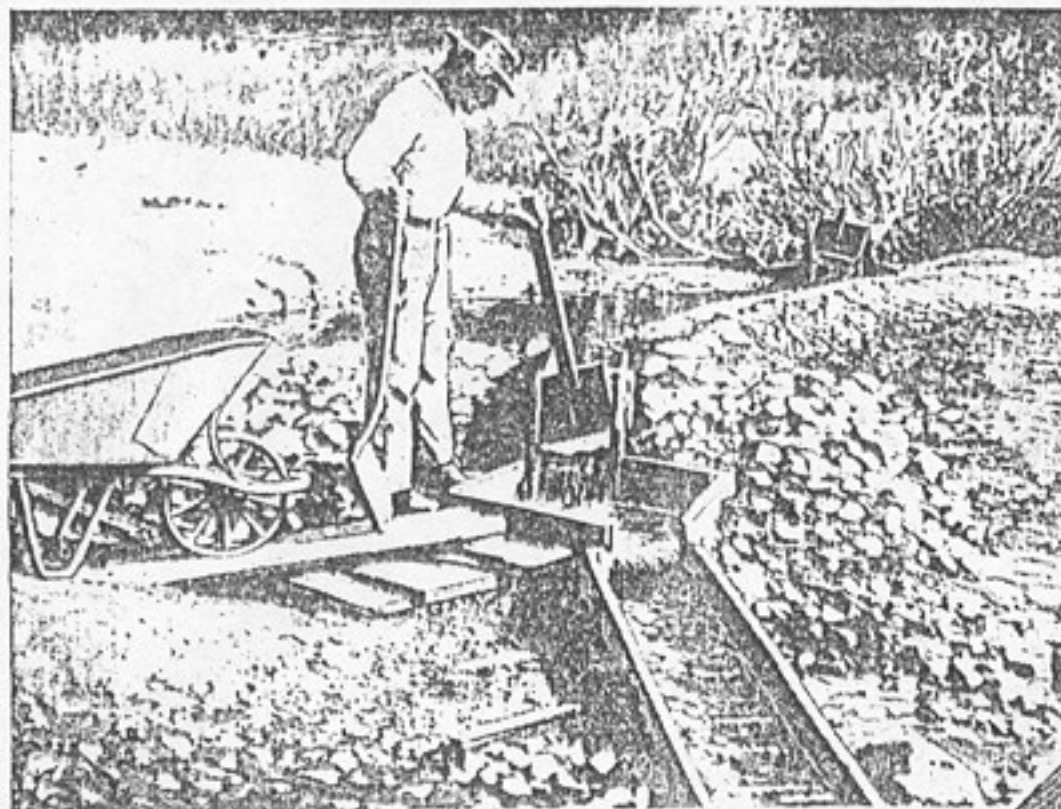
POPULAR MECHANICS AUGUST, 1931

Here Is a Prospector with His Pan Washing the Gravel in His Search for Gold as Thousands of Old-Timers Have Done

after every business depression, accompanied by a fall in the price of silver, thousands of men have gone out to comb the western hills. In the past, each of these searches has revealed bodies of ore that were previously unknown.

A complete prospecting outfit consists of several sizes of basinlike pans, an iron mortar and pestle, a magnifying glass, bottles of quicksilver and muriatic acid, a square of chamois, a pick and shovel, supplies, and perhaps a dry-washing machine. Those who carry a complete outfit usually travel in a "tin burro" or stripped-down car in which they can reach seemingly inaccessible spots. Others travel on foot, alone or with a burro, some carrying only one pan with which to prospect.

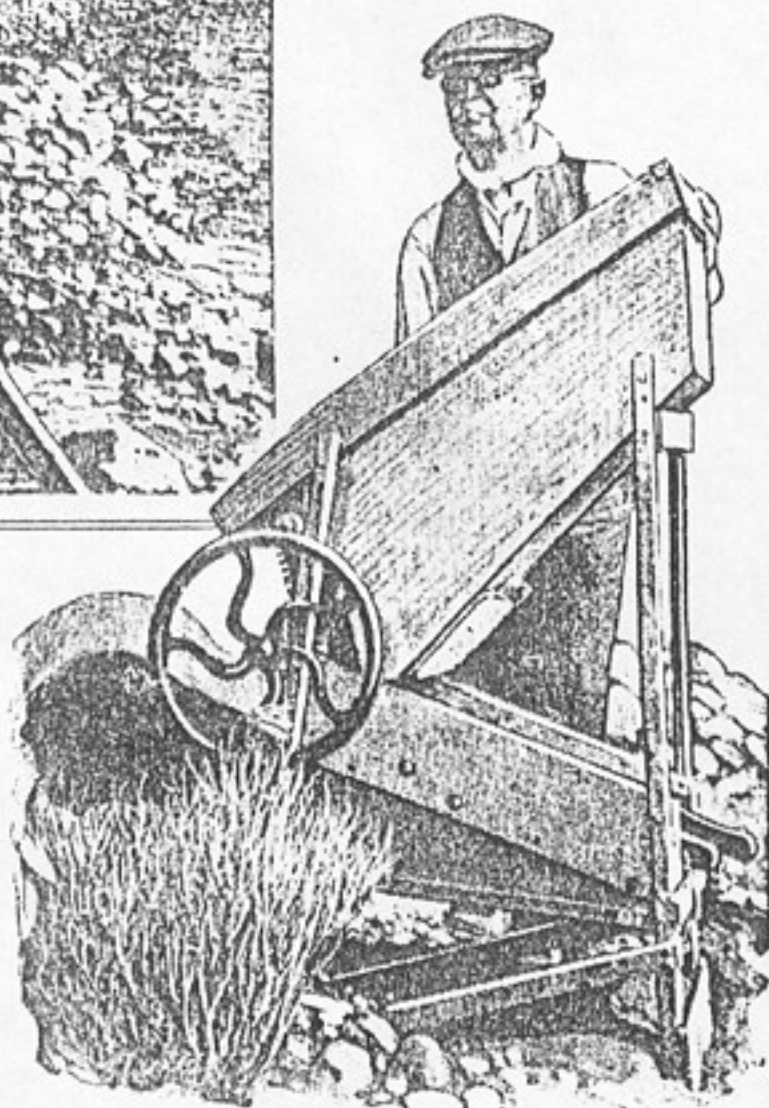
Placer gold is found in river sands and gravels, and gold ore is found in the hills. What a prospector looks for depends upon the surroundings. Placer gold is loose



To completely separate the gold from the black sand would be too long a task, so the prospector drops a small amount of mercury into the pan and swirls it. The mercury picks up

and consists of tiny specks and grains, with sometimes a larger nugget. Coming across a likely-looking stream, the prospector proceeds to pan for "colors." Gold is rarely found in the pools or at the bends of a river. The wise prospector fills his pan with gravel from a point or a bar. Some prospectors use nothing but a frying pan; others carry three pans graduated in size from eighteen to six inches wide so that as the gravel is concentrated they can shift to a smaller pan.

Half filling the pan with gravel and then filling it with water, the miner swirls it around with a circular motion, holding it at a slight tilt so that some of the water runs over the edge. This separates the materials, the heavier and finer grains moving to the bottom and to one side, while the larger and lighter grains accumulate on top and at the opposite side. These the miner throws away by working them over the side or scraping them off. He dips it constantly into the stream so that it is kept full of water. Soon nothing is left in the pan but a small quantity of heavy material, consisting mostly of black magnetic iron sand. If gold is present, the miner can often see it at once; or by rapping the bottom of the pan with a rock, causing the sand to bounce up and down, the heavy particles of gold are tossed into the air where they may be seen. A few drops of muriatic acid brighten the gold.



Top, a Makeshift Flume to Recover Gold from River Gravel; Right, a Homemade "Dry Wash" for Concentrating Pay Dirt

any gold that is there. Then the mercury is strained through the piece of chamois, leaving the flakes of gold on the surface.

Gold in the surface gravels usually means richer pay near the bedrock. The particles of heavy gold tend to sift to the bottom of the gravel. Sometimes the natural riffles and pockets on the uneven surface of the rock beneath the river actually collect handfuls of gold.

Heavy black sand is generally taken to mean that gold is present, but it is not a sure test. Banks of clean washed sand rarely contain gold. Colors and shades of red and blue in the sands of a gravel deposit are considered by miners to be a good sign that gold is there.

As placer gold is always washed down-

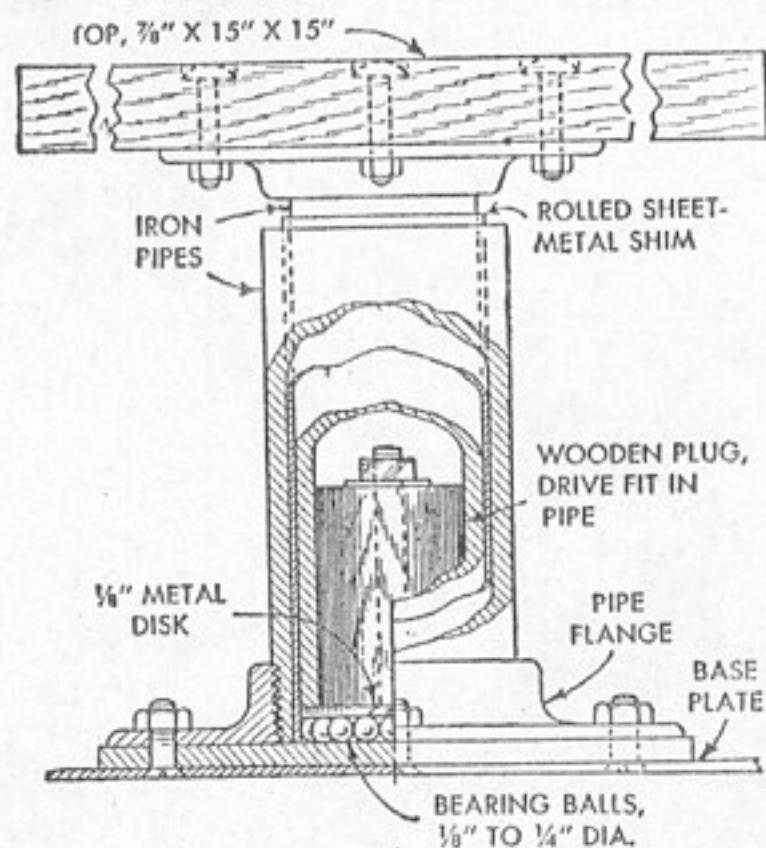
stream from a mother lode, the prospector slowly works his way up the stream until gold is no longer found in the gravel. Then he carefully combs the surrounding hills to discover the lode. Sometimes he finds "float" in the river bed—small chunks of ore containing gold. This is definite proof that somewhere upstream there exists a large body of gold ore.

Dry panning, similar to wet panning, is done when no water is available. The dirt must be crushed. Properly done, all the gold may be saved. If gold in paying quantities is found, a portable concentrating machine known as a dry washer

is used. Dirt is dumped through a screen into a hopper which feeds the dirt out slowly on an incline across which baffleboards have been nailed. The incline is vibrated by turning a wheel, and the dirt slowly falls off the end. All of the heavy material, including any gold, is held by the riffles and is scooped off later.

The prospector does not confine himself to streams. "Gold in the grass roots" denotes easy riches and several mines have been discovered by pulling up tufts of grass. However, such gold is usually found on hilltops and more of it than farther down.

Ball-Bearing Turntable for Assembly and Repair



The turntable top, or platform, can be turned easily in either direction because it's mounted on ball bearings

POPULAR MECHANICS, 1948

When repairing motors, typewriters, household equipment or other intricate mechanisms where it is necessary to get at all sides of the assembly, a bench turntable saves a lot of labor and time. With the type detailed above the motor or other unit to be disassembled is simply placed on the hardwood top and, if necessary, bolted or clamped in place so that it cannot shift.

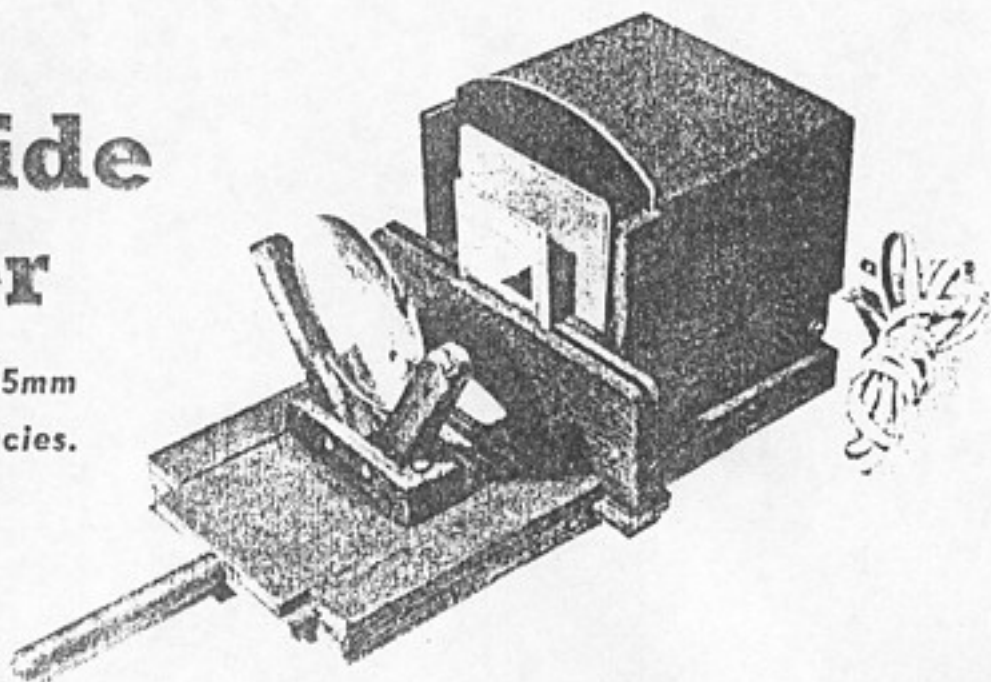


Once in position all parts of the work can be reached by rotating the top in either direction. The turntable stand is made from pipe and fittings. All the weight is carried on an improvised ball bearing as will be seen from the cutaway view above. The column can be any length for either floor or bench mounting and the diameter of the column can be large or small.

color slide viewer

Handy for showing 35mm or 3 1/4 x 4 1/4 transparencies.

By Harry Ross



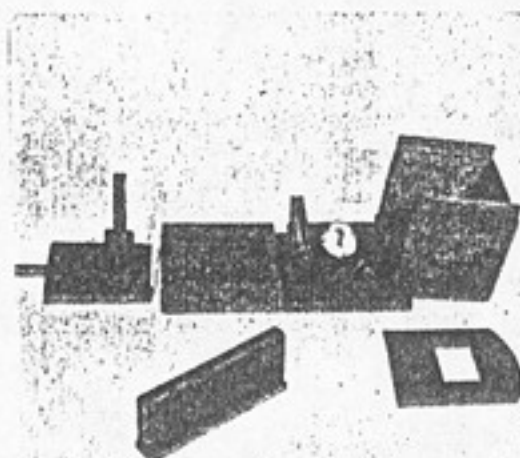
MECHANICS ILLUSTRATED MARCH, 1951 The completed slide viewer ready for use.

THE total cost of this viewer should be under \$1.50. A lot less than some of the present viewers on the market and a bit more practical, it takes transparencies from 35mm up to 3 1/4 x 4 1/4. If larger slides are to be viewed the simple plans can easily be enlarged. One-quarter inch boxwood can be finished off and made into a nice looking viewer or plywood of the same dimensions will do the job quite well.

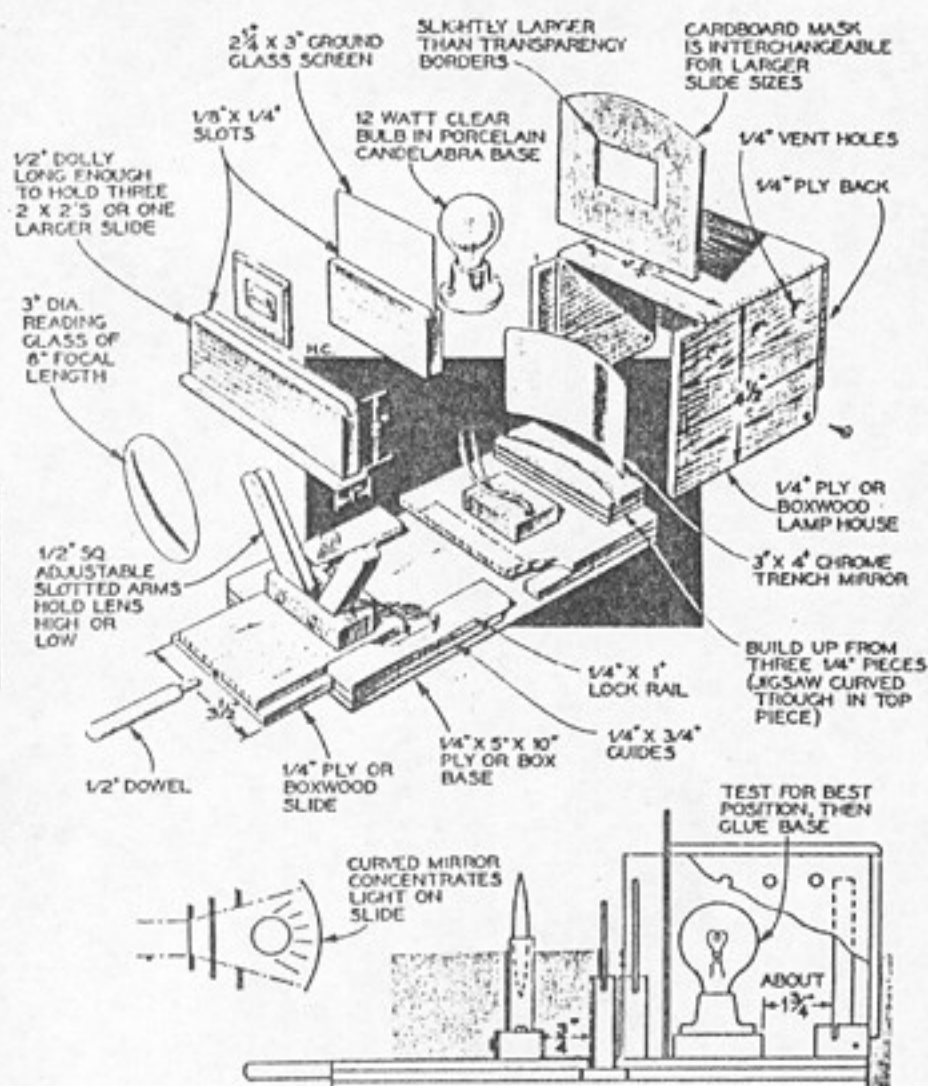
The carrier will hold three 35mm slides

at one time. It slides across its mounting parallel to the viewing lens and ground glass window. The lens is mounted into two adjustable slotted arms and can be either raised or lowered depending on the size of the transparency to be viewed. The dowel handle is used for focusing the lens and the track the whole mounting runs on should be just slightly snug.

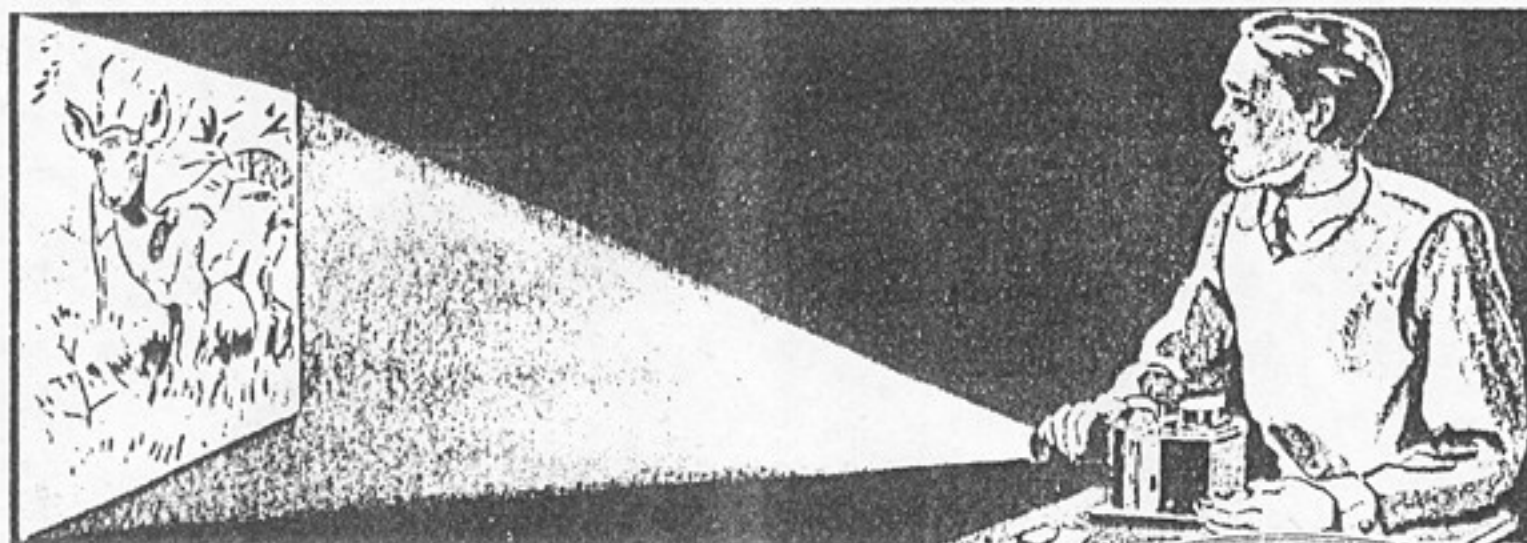
A coat of stain and some furniture polish will finish off the job. •



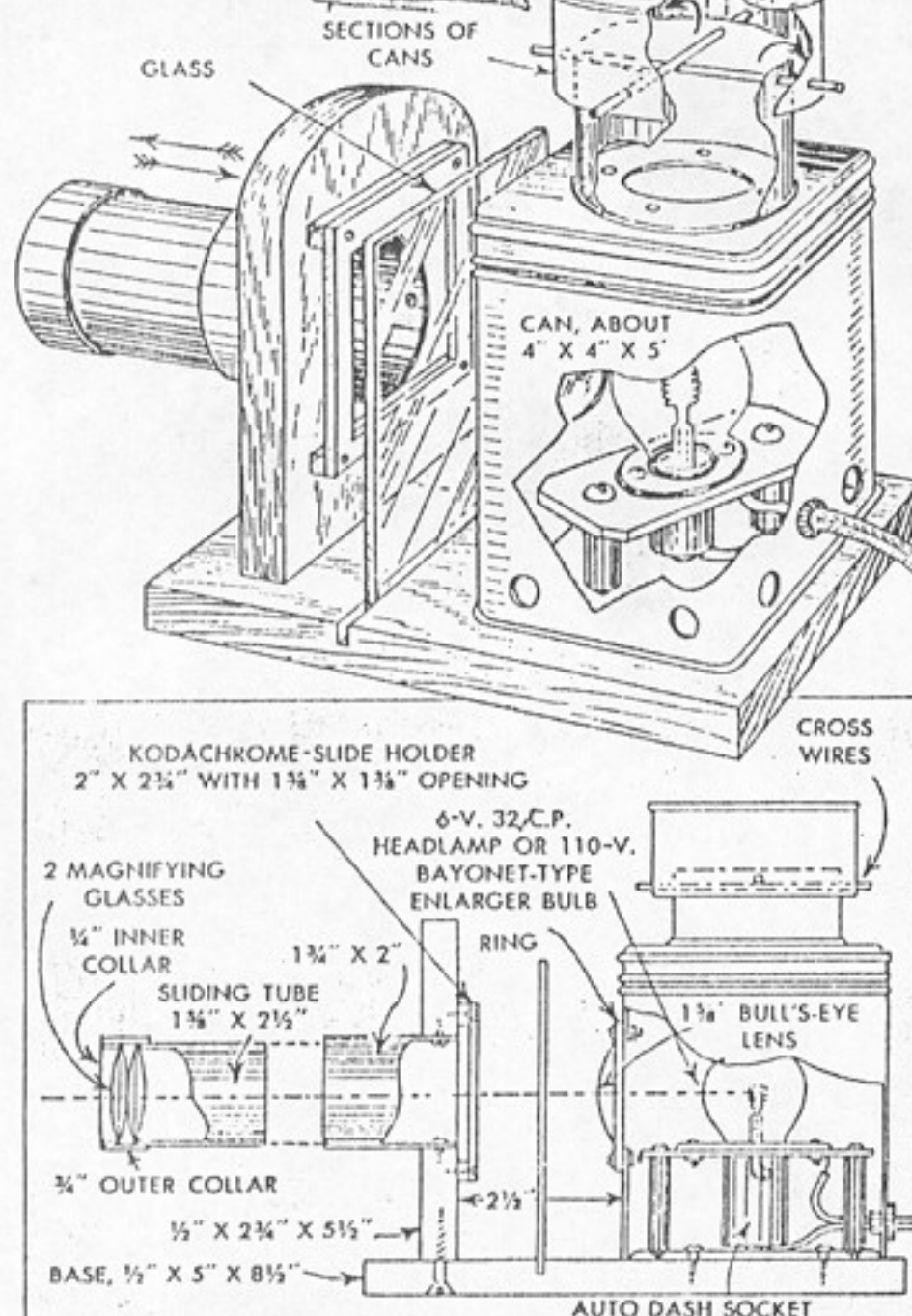
Above: The simplicity of the parts makes it an easy project. Below: The author shows it is light enough to hold for viewing.



Miniature Slide Projector Costs Two Dollars



This tiny projector for miniature Kodachrome slides was made from old tin cans, scrap pieces of wood, some tubing, two dime-store magnifying glasses, a bull's-eye flashlight lens, a single-contact auto-dash lamp socket and a 110-volt miniature enlarger bulb to fit, besides a length of lampcord and a plug. A 6-volt auto headlight bulb can be used if a storage battery or a suitable transformer is available to supply current, although a 6-volt lamp connected in series with a 450-watt heating unit was used successfully instead of a battery or transformer. Ventilation is provided by holes in the sides near the bottom and a "cupola" at the top, which does not allow much light to escape. The socket is mounted on a piece of fiber or hard-pressed board and two fiber bushings or drilled dowels space it from the base to which the assembly is fastened with slender wood screws. The bull's-eye lens is mounted over a hole cut in the lamp housing, the center of the lens being in exact line with the filament of the bulb. A ring of fiber or hard-pressed board holds the lens, the ring being attached with small machine screws. The lampcord should be protected with a small bushing where it passes through the can. To shield the slides from intense heat, a piece of glass the edges of which are filed dull, is set in a slot cut



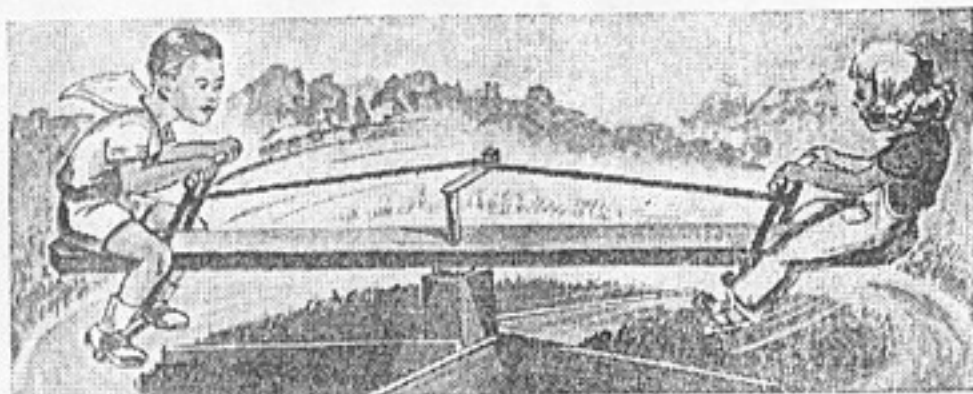
Popular Mechanics MAY, 1943

in the base. Cardboard or other tubing can be used for the telescoping lens mount, which must be adjustable for focusing. By using two magnifying glasses as shown, a life-size image is produced on a screen about 8 ft. from the projector.

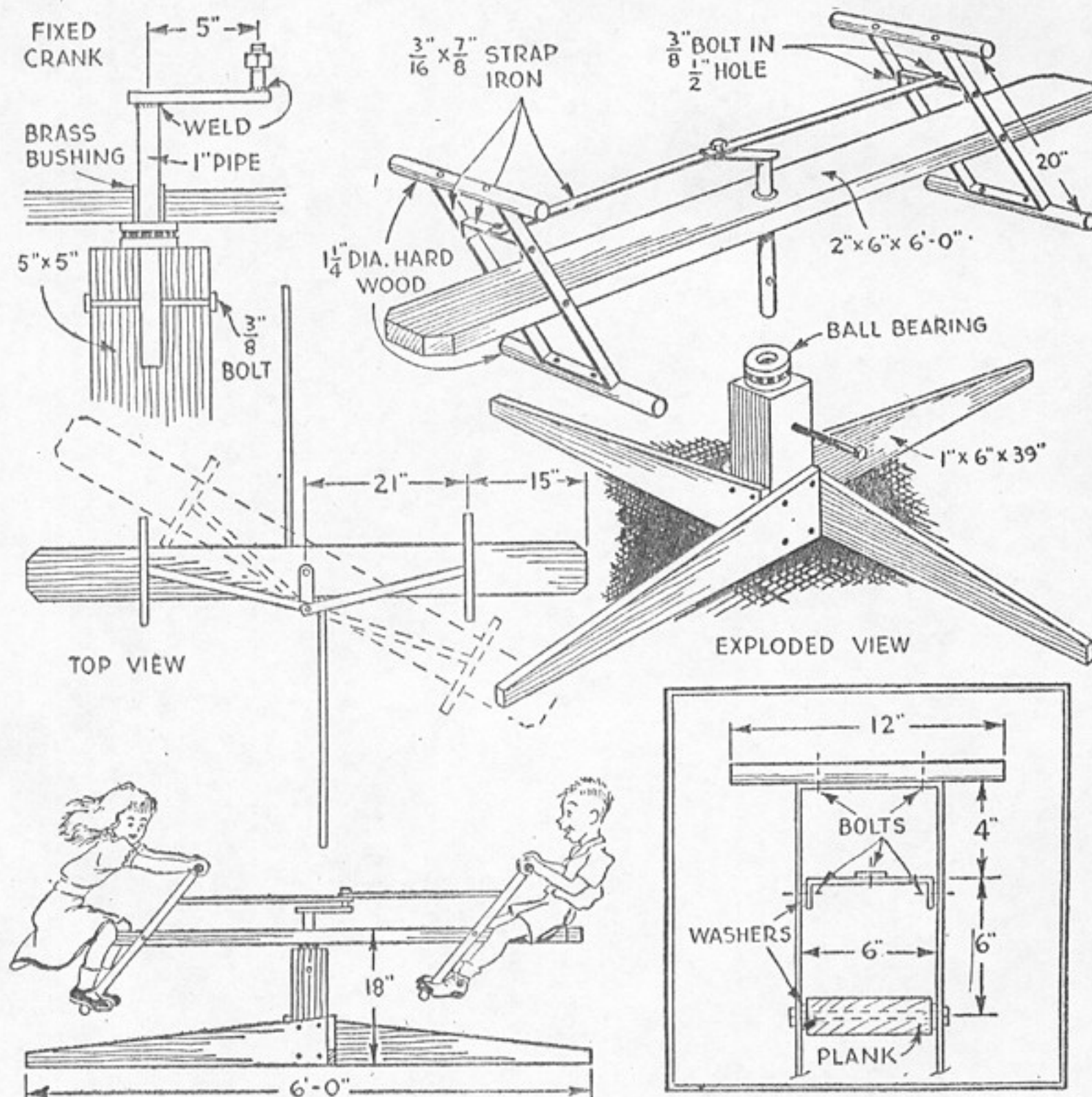
SCIENCE AND MECHANICS February, 1949

MERRY PUMP-AROUND

FEET as well as hands propel this novel Merry-Go-Round, giving passengers wholesome exercise as well as fun. It operates on the principle of "connecting rods" pushing and pulling on a fixed crank and there is sufficient leverage to work up lively rotation. The mounting is portable and consists of four 3 ft. legs screwed to a 5 x 5 in. post, in the top of which the crank is bolted. The plank rides on a sturdy ball-bearing and a brass bushing makes for easy running and reduction of wear. A drop of oil daily will bring friction to a minimum. Hand and foot bars are assembled as a unit, pivoted on the plank with a long bolt. For



the plank use a good grade of pine, surfaced on all sides and with corners rounded to prevent splintering. For outdoor use paint it two or three coats and use screws throughout instead of nails for the fastening.—H. SIBLEY.





8 TESTS THAT SAVE INVENTORS TIME AND MONEY



- 1 How widespread is the need?
- 2 How much money will your idea save?
- 3 How much competition is there in the field affected by your idea?
- 4 How sound is the basis of the industry your idea affects?
- 5 Will the change be too sudden for the public?
- 6 How much will it cost to put your idea on the market?
- 7 Is the idea enough of an improvement to warrant installing new machinery and scrapping that already in use?
- 8 Can your invention compete in price with rival products?

Is Your Idea Worth Patenting?

POPULAR SCIENCE MONTHLY APRIL, 1934

By CHESTER A. WEED

IF YOU tried to sell an Eskimo an electric fan, a South Sea Islander a sled, or a Sahara sheik a motor boat, the world would think you crazy. Yet, in effect, that is what amateur inventors are doing every day of the year. They are spending their time, their money, their energies inventing things nobody wants and for which nobody will pay.

Not long ago, one of my clients came to see me about getting a patent on a new kind of notebook. She was a woman who had taken out more than thirty patents over a period of years. I asked her if she had made any money out of them. She seemed surprised. "No," she said, "I never made a cent. But I think if I get enough patents, one may make me rich."

That has been the attitude of many inventors I have met in the nearly fifty years I have been practicing patent law. They have been inventing aimlessly, fumbling for the keyhole in the dark. And in the end, they have been disappointed in their expectations and have concluded the game is not worth the candle.

In fact a recent survey shows that a high percentage of all inventions never pay back the costs of getting the patent. This, I believe, may be traced largely to the fact that inventors so often fail to analyze the market and the demand for their ideas before they go to the trouble and expense of patenting them. This precaution should never be omitted.

In the hope of helping beginners avoid wasted time and money, I am setting down eight tests for estimating the demand for an invention and the prospects of making money from it. In the first place:

How widespread is the need?

The ideal invention, of course, is something everyone will use all the year around. Rubber heels, clothespins, mamma dolls, shoelace tips are universal inventions that have made fortunes. A new kind of coconut grater for housewives or a new kind of doll for children will have more chance of profit

than an automatic rhymers for poets or a clawproof coat for lion-tamers—for the simple reason that housewives and children outnumber poets and lion-tamers. If your idea fits in the home, in business, or in an important branch of manufacturing, its chances of making money are greater than if it is confined to the theater, the golf links, or the shooting gallery. Ask yourself the question: What class of people will need my invention and how large is the group comprising the class?

If your idea is an improvement on an article already in use, find out how many of these devices are sold annually. If it is an entirely new development, ask experts in the branch affected by it, without telling them the details of the invention, what the demand would be for the idea if it actually does what you claim it will do.

One invention for which there has been a wide demand for years is a non-refillable bottle. A standing offer of \$1,000 has been made by one hair tonic concern for such a container as

Many inventions are about as badly needed as a good electric fan by an Eskimo.



it would prevent refilling the bottles with counterfeit products.

Hundreds of patents have been taken out on such bottles. Some have trick valves at the top; others a labyrinth of channels winding through the solid glass of the neck. In both cases the idea is to allow the liquid to flow out but not in. So far, however, all of the attempts have been either unsuccessful, too costly, too easy to tamper with, or too hard to manufacture and fill. The rewards are still open for the man who can solve the problem in a cheap and simple way.

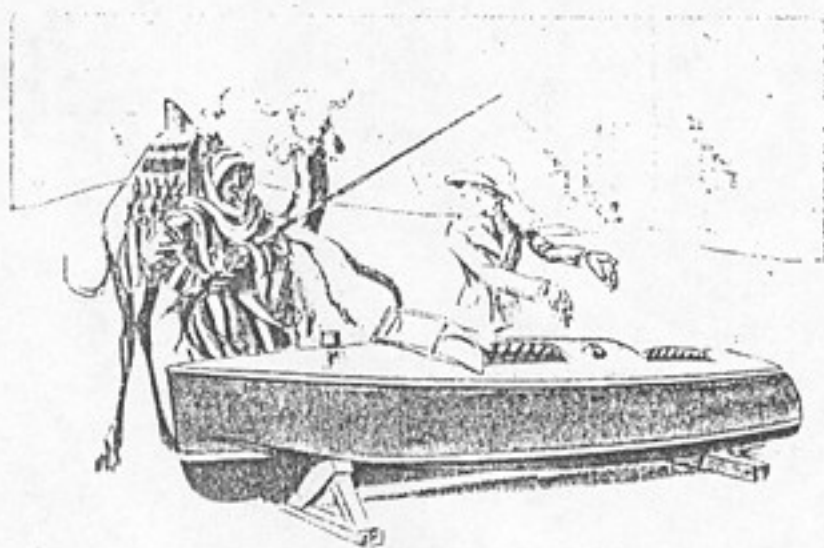
Another way of estimating the need is to check up on the frequency with which the device is likely to be used. If it is something that is needed a dozen times a day, it is a better bet financially, other things being equal, than if it is used once a week or only on the Fourth of July.

One striking exception to this rule was an involved mechanism upon which I once helped an inventor obtain a patent. He had worked for years upon it although it was designed to be used only once in a decade. It is employed to sort and file statistics during a census. Although its use is not widespread, its high-speed, time-saving features during the rush work are worth vast sums to the government. Its value lay in the way it answered Test Number Two, namely:

How much money will your idea save?

If you invent a machine that turns out the same article at half the cost, you will have no difficulty interesting manufacturers. However, if you invent an article that will wear twice as long, the result may be another story.

A number of years ago, a new kind of non-skid chain appeared on the market. It was designed with solid links across the tread of the tire so it was almost impossible to wear it out. Another concern sued the manufacturer and in court was able to obtain a decision preventing the sale of the new chain as an infringement on a prior patent held by them. But afterwards, no one ever manufactured the superior chains. They disappeared from the market. They wore too well, so well



You could hardly expect a desert sheik to get excited over this

motorists did not need to buy new chains for many, many years.

It is well for an inventor to keep in mind, when determining whether his idea is likely to prove profitable, that just because it is an improvement does not necessarily mean it will be welcomed by manufacturers. An idea may be a good idea, a valuable idea, and yet an idea nobody wants. Manufacturers are in the business of selling certain merchandise. They are not apt to welcome innovations which reduce the market for this merchandise.

Puncture-proof tires, having all the qualities of present-day tires, for example, would be welcomed by motorists, but probably not by tire makers. They would cut down the demand for tires by lasting too long. Some have already been invented, but they are not on the market.

In an industry where the competition is keen, there is always a better chance of finding a concern to accept your idea. In fact, Test Number Three for estimating your prospects of making money from your idea is:

How much competition is there in the field affected by your idea?

If your invention is intended for use on automobiles, for instance, you have a wider market than if it is to be used on cameras, for there are many more motor-car makers in America than manufacturers of cameras.

Probably the best example of the importance of this factor is the case of Adrian de Pinie-Mallet, a French boarding-house keeper in New York City.

Early in the present century, he came to my office with drawings of a new kind of bed. In his boarding house he had been using single beds in small rooms. However, often double beds were needed and after working on the idea for some time, he finally produced what proved to be the father of the modern day-bed which can be opened into a double bed at night and contracted into a single one in the daytime.

Six feet, two inches is the standard length for beds. Mallet took two wooden cots, with spring fabrics stretched between the ends and cut an inch or so from the end of one. This permitted it to slide in between the endboards of the longer cot. By substituting rollers for legs on the inner side, he produced a bed that would telescope in, at the same time keeping the spring fabrics or tops of the cots substantially level with each other. Because mattresses of the same thickness could be used on both cots, the Mallet bed was a great improvement over the old trundle bed in which the smaller of the two beds was much lower than the larger one.

The idea seemed so obviously of value to him that he thought the first manufacturer he ap-

Selling a sled to a South Sea Islander would be a cinch as compared to the job of finding a market for some ideas that uninformed inventors try to develop



proached would snap it up. But, although the beds made a fortune when they did appear on the market, Mallet had to argue with many different manufacturers in New York, Boston, and elsewhere before he found one with sufficient insight to see the possibilities

for profit contained in the invention.

On the day he received his money and stock in payment for the patent, he offered me a substantial sum in addition to my regular fee. This, of course, I refused. Then, he insisted on buying me a \$500 Swiss watch which I still have.

Sometimes when I look at it, I wonder what would have happened if there had been only one or two makers of beds in the country at the time. The fact that there was considerable competition in bed manufacturing and a large number of concerns engaged in that line, enabled Mallet to dispose of his invention.

IN CONTRAST, take another case. A few years ago, an inventor brought me plans for an automatic mechanism for producing graphs to show the trend of the stock market. It had a limited number of possible openings at best and after he got his patent the crash of the market left it practically unwanted. The fate of many an invention hangs on the rise or fall of the business with which it is connected. So, test Number Four is:

How sound is the basis of the industry your idea affects?

Shortly after the World War, an American inventor developed a superior type of hairpin and obtained a patent upon it. Then, hardly had it been put upon the market, when the bobbed hair craze swept the country. His idea, which otherwise might have been worth millions, was worth practically nothing, just as ostriches were a drug on the market when women no longer wore ostrich feathers in their hats. Another inventor perfected a new kind of corset just as women quit wearing corsets and a third devised an improved method of distilling whisky just before prohibition came. Now that repeal has arrived, his patent has expired.

Usually, inventions in the field of fashion are among the greatest gambles as regards profits. Fashions may change overnight and a patent which is valuable today may be worthless tomorrow. Again, the value of a patent waxes and wanes as the volume of business in a specific field changes. When automobiles appeared, the demand for buggies dropped. A wise saying among veteran inventors is: Never strive for a patent in a dying field.

On the other hand, it is just as bad to arrive too soon, to make an invention before its time. More than twenty years ago, one of my clients devised an automatic switchboard for telephones. He set up an elaborate demonstration room near Fourteenth Street, in New York City. His mechanism worked perfectly but it was not needed at the time sufficiently for telephone companies to become interested. Now, after his patent has expired, the maze of telephone connections in big cities makes the automatic switchboard a necessity. The lucky inventor is the one who patents a needed invention for an industry which is at its peak.

THERE is always a problem for the inventor when his idea concerns an industry which is expanding rapidly. If he patents his idea at once, it will run out in seventeen years, perhaps just as the industry reaches a point where the invention is beginning to pay. If he delays, keeping silent about his inven-

tion, his application may be thrown out for "lack of diligence" in putting it into practice. Or some other inventor may hit upon the idea and apply for a patent in the meantime.

I recall one instance in which two inventors, working independently in different parts of the country, applied for the same patent on the same day, their letters arriving at the Patent Office at identically the same hour.

In this connec-

tion, a fact which few people realize is that an inventor may apply for and receive a patent upon an idea even after someone else has applied or even been actually awarded a patent upon the same idea. But he usually has to prove beyond all reasonable doubt that he conceived the idea and reduced it to practice before the other man did so and that he was diligent. This usually means a hard and costly battle. The wisest course is to be first in the Patent office.

A few months ago, a New York advertising agency worked out a scheme for selling more ammonia for one of the companies it represented. It decided that by coloring the fluid a bright hue, they could make it stand out on the store shelves and attract the eye of the customer. The plan was tried and immediately the sales dropped to zero. People had been used to seeing ammonia colorless and they thought something was wrong with the colored product. The change was too sudden for them to appreciate all at once.

THE same principle applies to many inventions. They may be sound enough but they do not prove profitable because the public does not take to them. They give the wrong answer to Test Number Five:

Will the change be too sudden for the public?

Probably the easiest kind of an invention in which to interest a manufacturer is an improvement on a widely used device. For example, an improvement in a typewriter would be more welcome than an entirely new kind of writing machine. Manufacturers naturally hesitate about embarking on new ventures but they are usually ready to add an improvement to an established line. The latter costs but a fraction of the former. And Test Number Six is:

How much will it cost to put your idea on the market?

If your innovation is too radical a departure, it may require the scrapping of machinery which represents an investment of hundreds of thousands of dollars and the installation of new machines. Before you approach a manufacturer with such a proposition, be sure your idea passes Test Number Seven, namely:

Is the idea enough of an improvement to warrant installing new machinery or scrapping that already in use?

On my docket, I have data of nearly a hundred patents I obtained for a client on bottle caps. They are all practicable. Only a few were ever manufactured, but billions of those few were sold and are still being sold. The others were not of interest to the manufacturer who had taken pains to build up a demand for the type in use.

While there is a definite group of innovations, called "Talking-Point Inventions", which have little real value and are used simply to provide salesmen with talking points, such ideas are usually produced by employees of the companies and not by outsiders. When you have an idea, look it over and be sure it represents a real improvement and not just

another way of doing something.

expensive. Although the idea was a good one, it had no chance of making money after another experimenter turned out a small wire heating unit which could be attached to the outside of the glass and which could be manufactured so cheaply it sold in ten-cent stores.

Unless your invention is so superior that its merits are easily seen, the chances of its sale are small if its cost exceeds that of similar products now on the market. Experience has shown that it is easier to sell a million articles at a profit of one cent apiece than a hundred thousand at a profit of ten cents apiece. So if your device can find a place in five- and ten-cent stores, its chances of bringing in profit are usually excellent. When the price exceeds five dollars, salability drops rapidly.

YOU probably have heard stories of how sudden flashes of inspiration have produced valuable inventions. Cierva, the inventor of the autogiro, for instance, thought of the idea which made that aircraft a success as he was watching a play in a Madrid theater. Henry A. Wise Wood, noted for his work in the realm of printing presses, has had some of his best ideas just as he awakes in the morning. A third experimenter reports his inspirations come most frequently while he is taking a bath; a fourth while he is listening to a sermon in church. It is important to note, however, that in every case the flash solves a problem upon which the men have been working for a long time. They first decided what was needed and what would prove profitable if they could invent it. Then they set out to overcome the obstacles in the way.

A plan for helping inexperienced beginners to confine their efforts to inventions which are in demand has been suggested by a well-known inventor, whose proposal is quoted in Joseph Rossman's "The Psychology of the Inventor." His scheme is to establish a government board composed of experts from every line of industry. Any citizen who discovered something or who had an idea for an invention could present it to the board in secret session and could be advised whether it was worth following up or should be abandoned. Although he would not have to follow the board's decision, he would have the benefit of its advice. Thus, the proponent of the plan points out, inventors might be saved years of effort and millions of dollars.

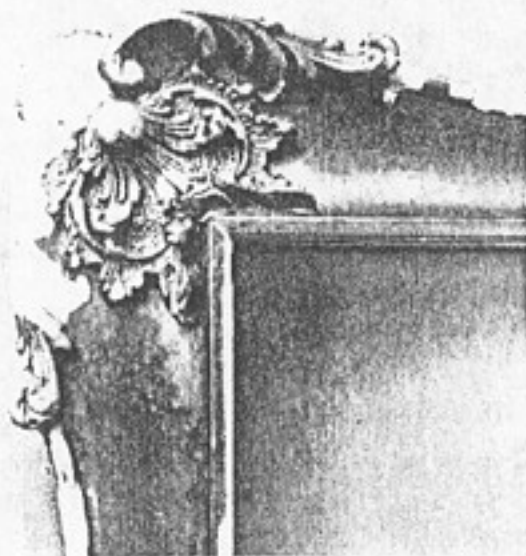
However, it is not likely that this plan will be adopted in the near future, if it is adopted at all. In the meantime, the best guide I know for gaging the demand for an invention and its probable worth are the eight tests mentioned at the beginning of this article.

Before you go to the trouble and expense of completing and patenting your idea, give it these eight tests. They will go far in helping you to avoid blind alleys that lead to disappointment.

SOMETIMES, even though your idea is superior to anything on the market, it may fail to prove profitable because it cannot compete in price. The Eighth and final test is:

Can your invention compete in price with rival products?

Take the recent case of an inventor in Canada, who devised a method for keeping sleet and snow from windshields. His idea was the placing of electric heating wires between the layers of the shatterproof glass. This was done at the time of manufacture and was rather



Before. Battered frame was purchased at rummage sale for 75 cents. Corners were gone and sections of molding destroyed



After. Same corner, restored as described in the story. From a distance, the rebuilt part blends in well with rest of frame

Restoring a plaster frame

SUNSET MARCH 1966

An ornate gilt-plaster picture frame can be restored and refinished so one would hardly know it from the original—and it doesn't take a professional to do it. It's not a process that can be rushed, however. Indeed, it may give you a greater appreciation of why the professional framer's work takes time and costs money.

You can buy the materials at a paint or art supply store. You will need white glue, a small box of powdered spackle (patching plaster), a knife or fingernail file, sandpaper, and an ice pick or something similar; also a small bottle of clear white shellac, a spray can of gold paint, a small bottle of clear picture varnish, one small tube each of burnt umber and raw umber oil paint, a 1/2-inch wide artist's brush (or other small brush), and turpentine and alcohol to clean the brush.

Artists' moulding clay can be used instead of the powdered spackle. If you use it, fol-

low the directions on the can.

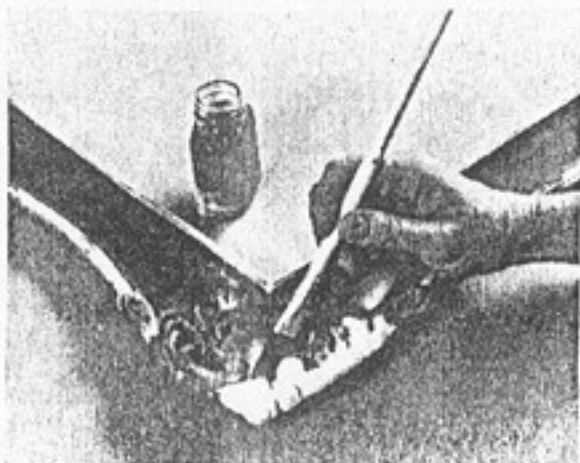
Restoring the plaster detail. Remove the backing (and the inner section, if there is one) from the frame. Replace any loose pieces of plaster with white glue; let dry. Mix the spackle with water according to directions on the box, and start to rebuild the ornamentation. Fill holes and dents, and start to build up the missing sections with layers of spackle about 1/4 inch thick.

Let each layer dry (about half a day) before applying a second one. Repeat until the spackle stands slightly higher than the surrounding frame. When the final coat is dry, sand it down until it's level with the original surface.

With a pencil, draw an outline of the original design on the new plaster. It need not be exact. Using an ice pick, a knife, and the folded edge of a piece of sandpaper, carve the design, cutting the



Here's what you work with. Sand spackle smooth, pencil in design, carve new material with ice pick, knife, and sandpaper



Apply coat of transparent shellac with 1/2-inch-flat artist's brush to seal spackle, provide base for gold paint and antiquing

grooves the same depth as the original design. A vacuum cleaner is handy for removing dust and chips. Sand the new plaster smooth and sand away any rough spots on the original gold finish.

Refinishing. Coat the new plaster with transparent shellac, using the flat brush. This seals the spackle and forms a base for the paint.

Let the shellac dry and clean the brush in alcohol. Then spray the entire frame with gold paint. Let it dry.

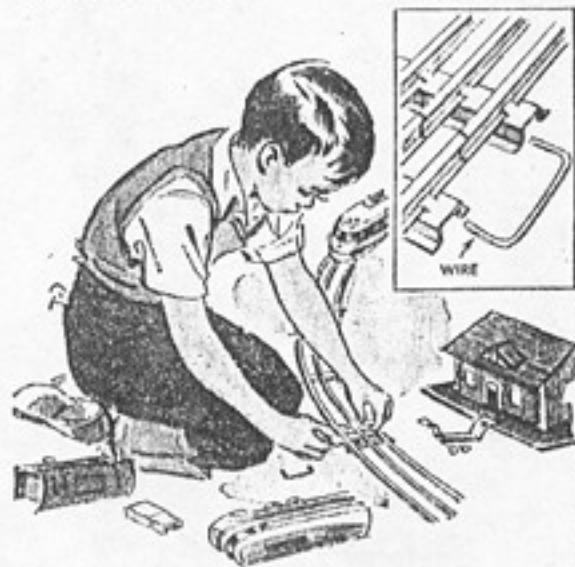
Antiquing. Pour about 1/4 cup of clear picture varnish into an old cup or a small tin can. Add a few drops of turpentine and about 1/4 teaspoon each of burnt umber and raw umber oil paint. Mix well and test the glaze for color on a corner of the frame. If you want the glazing to be darker, add more oil paint.

Brush the glazing mixture into all the cracks and corners, then coat the whole frame with long strokes. Let dry for about 5 minutes; then take a soft cloth and wipe the glaze with long, gentle strokes, leaving just enough color to produce a light, streaked effect. Wipe the high spots until you have achieved the effect you want.

If the glazing dries too fast, you can put a few drops of turpentine on the cloth; be careful not to rub through the glaze to the gold. Set the frame aside to dry for about 48 hours.

Track Sections Held Together With Double Hooks

When sections of model railway track are not nailed down, preventing them from coming apart is often a problem. This can be avoided on some types of track by fastening the cross-ties at the track joints with



wire hooks. Since the length of the hook will vary for straight and curved sections, when the track is disassembled each size should be stored in a small box.

K. Springer, Aaronsburg, Pa.



These wood flowers can be made with wood shavings stained with food coloring

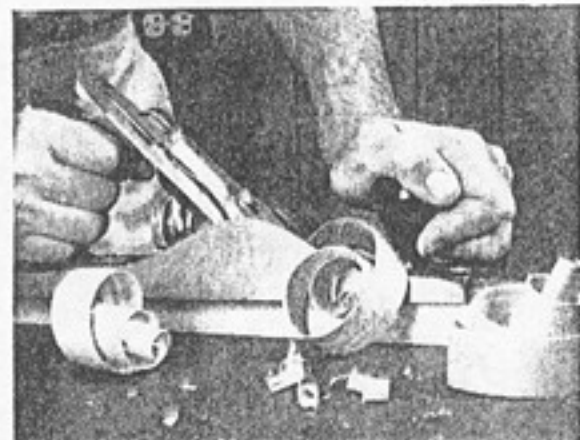
Wood shavings make flowers

SUNSET OCTOBER 1969

When Richard S. Shirley of Burlingame, California, was planing a piece of wood recently, he wondered how to use the shavings littering his workbench. These handsome wood flowers were the result. You simply take a wood plane, sharpen it well, set it for a thick cut, and try planing different pieces of scrap wood until you find one with a grain that will give long wide curls as shown below. The flowers shown above are made of cherry wood; the shavings shown below are balsam.

To assemble a flower, clamp a large needle vertically in a vise; with scissors cut petal shapes from the shavings, and push them down on the needle one at a time cementing them with a little white glue. To make

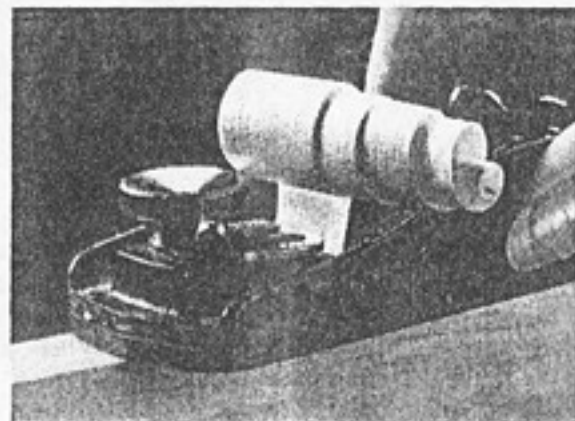
DARROW M. WALT



Adjust your plane for a thick cut; try different pieces of wood for long wide curls

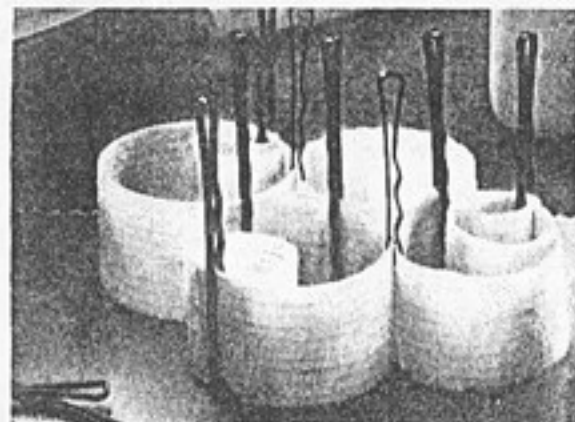
the stem, replace the needle with garden-er's tie wire.

When the glue was dry, Mr. Shirley dyed the flowers with diluted food coloring dye and streaked the edges of the petals with the same dye used full strength.



Use a plane to shave thin strips off inch-thick boards. Important: Use straight-grained white pine or similar soft wood

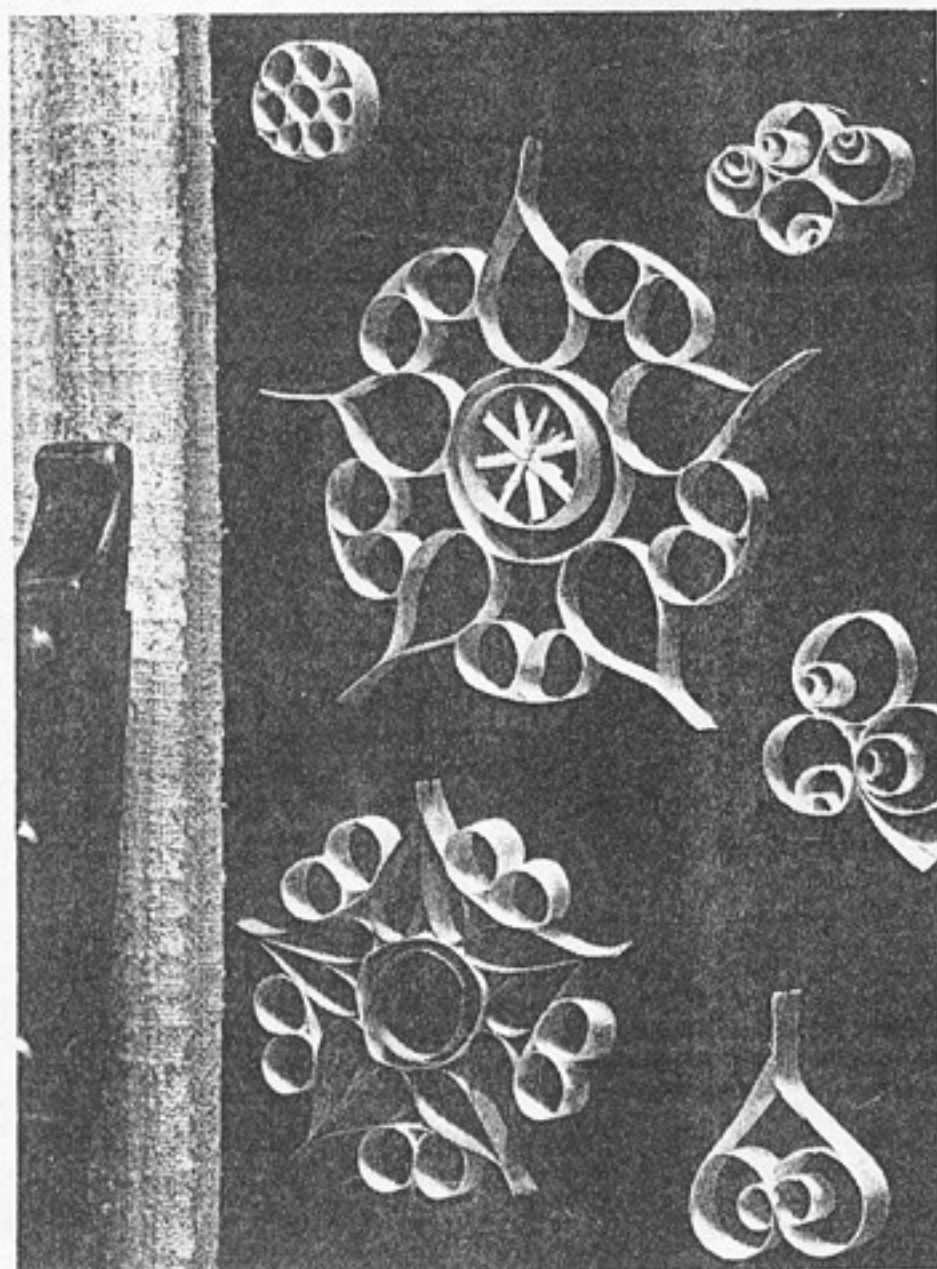
In their simplicity these wood shaving ornaments may remind you of Scandinavian furniture design. We left the wood



Soak shavings in water for 15 minutes; form designs and hold with bobby pins to dry; then remove pins and secure with glue

natural (but sprayed on a thin coat of varnish for a slight sheen and protection); you could spray on a color to blend with other decorations.

The shavings are pliable enough after brief soaking in water to form curls and circles; use your imagination to vary the designs. The smaller ornaments are good tree decorations; the large ones combine a variety of smaller elements.



Delicate wood shaving designs decorate a windowpane for holidays

How to Prepare Your Own

By VERNON B. CASE



Clear varnish or lacquer is applied in a smooth coat to the gummed side of "decal" paper, which can be bought or prepared with gelatin and starch



Designs are painted or printed on the lacquered surface. Water colors, oils, or ink may be used

Clear lacquer seals in the water colors. Be sure no pinholes remain, for the "decal" must be soaked



SPECIAL decalcomania designs, or "decals" as they are called, are easy to make for use in decorating furniture, china, trays, holiday windows, and doing a host of things that are difficult by other methods.

The special, coated paper that is required can be purchased at some art stores for about 20 cents for a 25" by 36" sheet, but usually no less than six sheets will be sold. Ask for the so-called "simplex" decalcomania paper rather than the duplex type.

To prepare your own, get several sheets of unsized paper, such as newsprint. Dissolve some dry laundry starch in boiling water in the proportion of about one teaspoonful to a half cup of water. This makes a thick paste when cool. Brush a layer of starch on one side of the paper, let it dry, and repeat with one or two more layers. Sometimes better results are obtained if the paper is first coated with a solution of gelatin. Clear dessert gelatin will do. Soak it in water to soften it, then heat until the gelatin is dissolved.

For small designs, the gummed side of gummed labels can be coated with starch. The gum, like gelatin, facilitates the transfer of the design.

The first step in making a decal design after the paper is on hand is to cover the starch-coated surface with varnish or lacquer. Ordinary clear brushing lacquer or well-thinned, clear spraying lacquer may be used. The latter generally does not have the

After soaking, the loosened design is transferred to a permanent surface by sliding out the paper



"Decal" Transfers

slightly yellowish cast that brushing lacquer has. Either can be applied with spray or brush. Be sure the lacquer coating does not contain any pinholes.

When the lacquer is thoroughly set, you are ready to apply the design. This can be done in various ways.

1. If you have a printing press, you can print on the lacquered surface with ink in the ordinary way. Let the ink dry thoroughly before attempting to apply the decalcomania.

2. Brushing lacquer of various colors can be used to draw designs and do lettering on the paper.

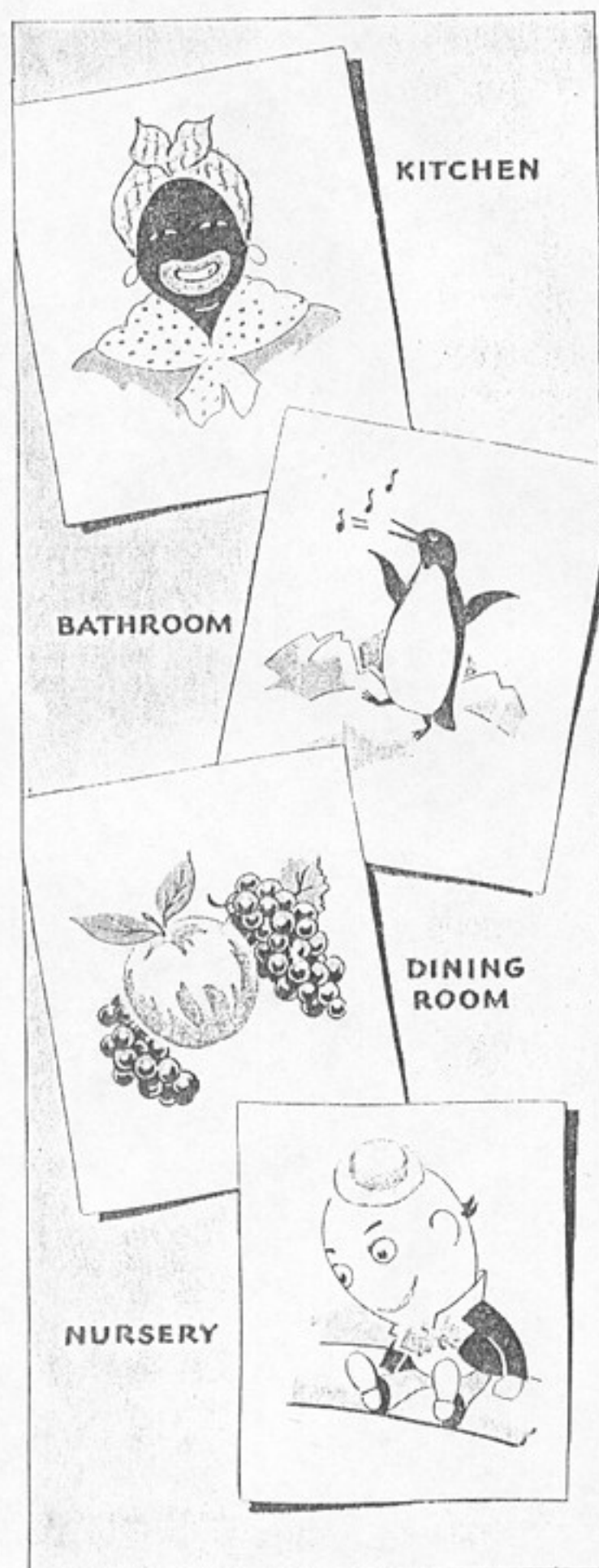
3. The silk-screen stencil process offers unlimited means of producing decal designs.

4. You can use ordinary water colors for painting pictures on the lacquer coating. This is probably the easiest method for the novice. After the water colors are dry, apply a sealing coat of lacquer over them. Be sure this coat is also free of pinholes or other flaws. Later, when you wet the design to transfer it, the lacquer protects the water-soluble pigments.

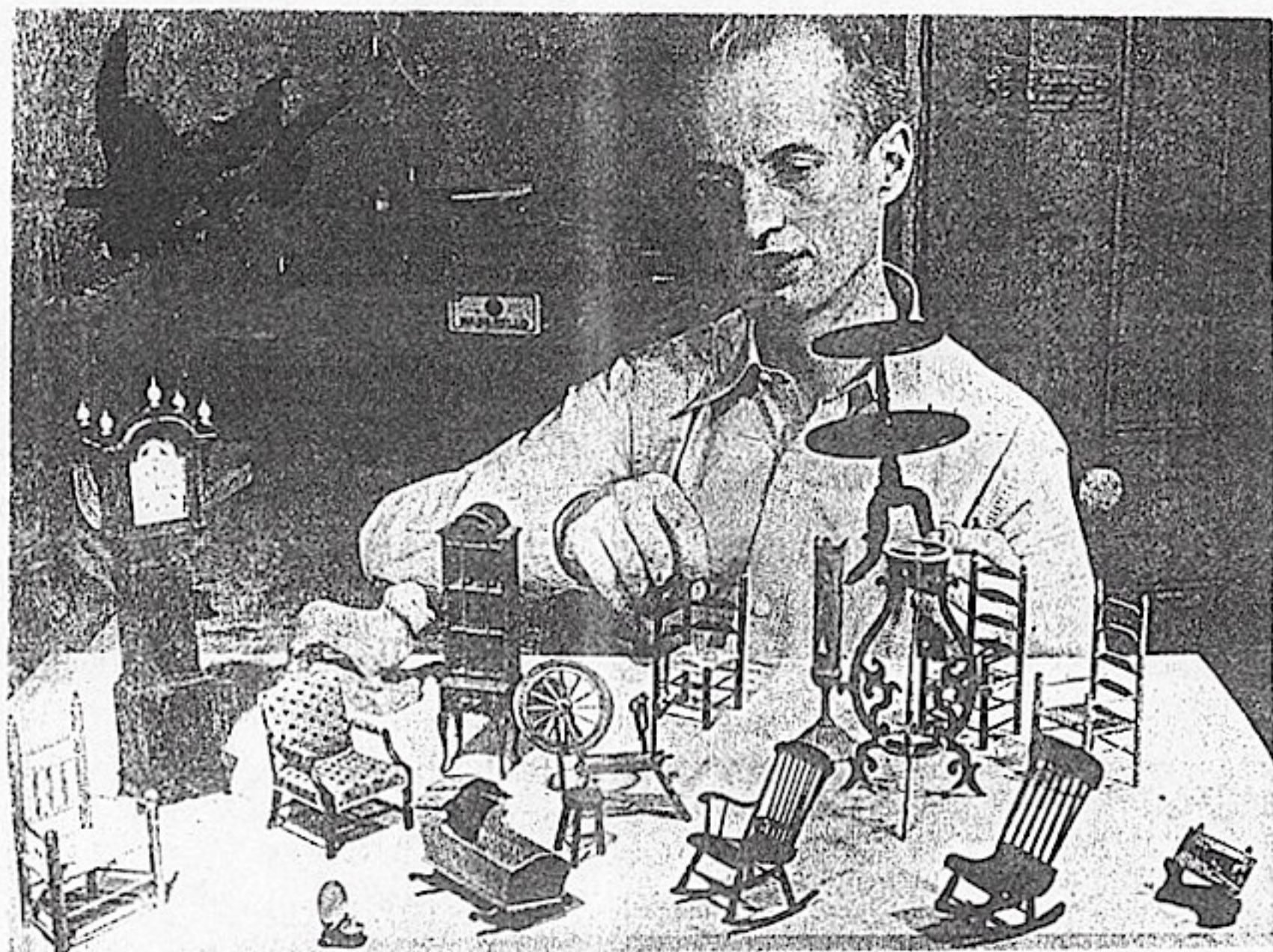
To transfer a decal design to another surface, either trim the paper to form a rectangle as small as the design will permit, or trim around the design in outline, leaving a margin of about $\frac{1}{8}$ ". Then immerse the paper in water to soften the gum coating so the lacquer film will slide off. When you use homemade, starch-coated paper, you may have to continue the soaking for several minutes. Commercial decalcomania paper requires less than a minute.

As soon as the design shows signs of loosening, push the top edge off the paper a fraction of an inch, hold it in contact with the surface on which the transfer is to be placed, and slowly draw the paper from beneath the lacquer film. The gum coating acts as an adhesive, so merely smooth out air bubbles, and your transfer is complete. Air bubbles that cannot be coaxed out by gentle pressure with a damp cloth can be deflated with a pin prick.

You can vary the procedure somewhat by coating the outer surface of the design with gelatin, letting it dry, and then soaking the transfer to soften both this coating and the one under the lacquer film. Apply the design to the surface with the paper-side out, and strip off the paper. When used this way, the design will be reversed.



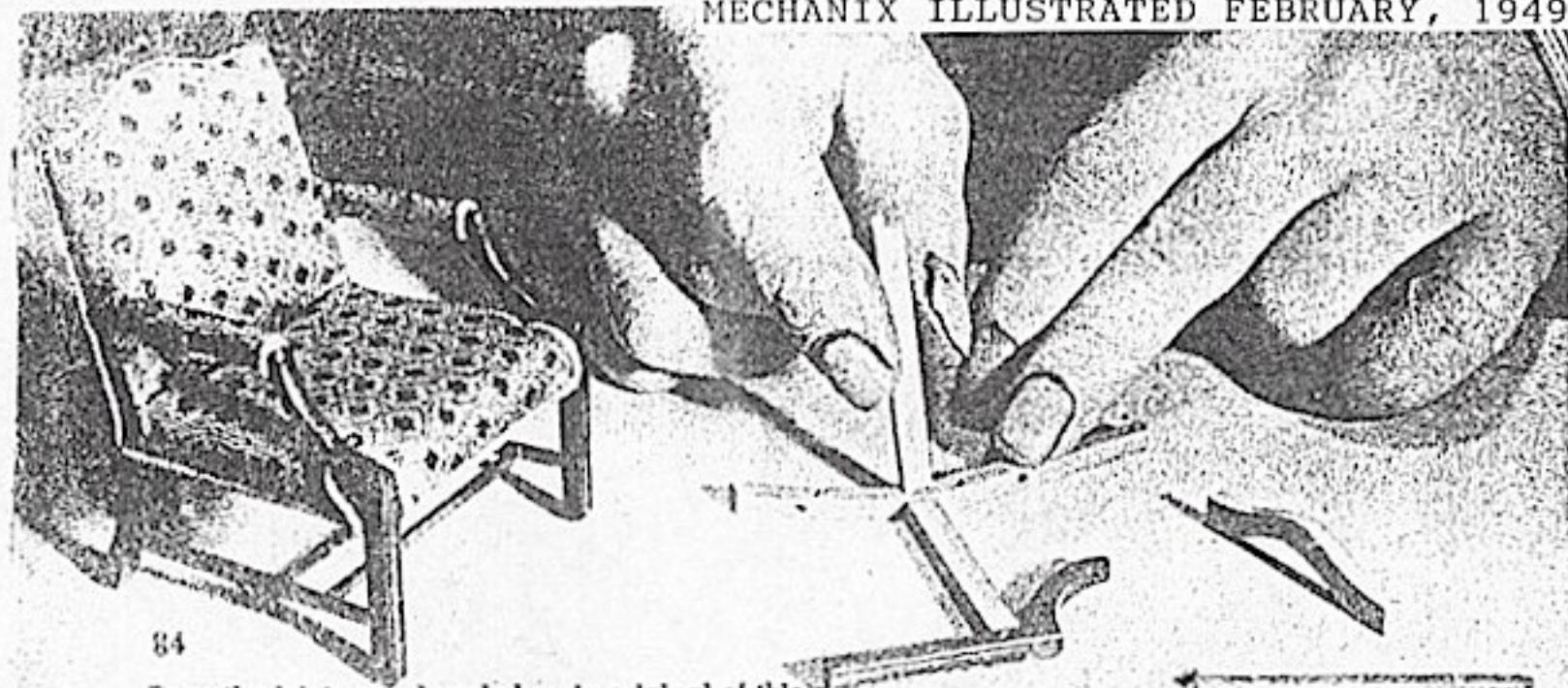
Four designs in smart-looking modern style prepared especially for readers who wish something a little different from stock decalcomania units



Master Micro-Carpenter

Model-maker William Kautter is custom builder to the nation's furniture fanciers. He turns out superb vest-pocket replicas of priceless antiques.

MECHANIX ILLUSTRATED FEBRUARY, 1949



By Louis Hochman

BUSINESS was too good! When William Kautter was a cabinet maker in the "old country" he followed all the local customs of the trade. One of them was to build small-scale models of a proposed piece of furniture to show the customer. If approved, he would start building the full-scale product.

Business boomed and Kautter found himself spending most of his time on models. And before long he had become a master model-builder as well as a master-carpenter. Soon, he switched completely to models and now makes his living in this country selling only his superb replicas.

Kautter uses no nails in his models. They're all doweled and glued like their full-scale counterparts. Even if there's a hidden dowel in the original, Kautter puts it into the model. As a result, his tiny pieces of furniture have a strength which belies their fragile appearance.

Accurate down to the last detail, Kautter even duplicates the original hardware by fashioning hinges, drawer pulls and catches from sheet brass and wire. Tiny doors on grandfather clocks and china closets swing open on delicate hinges, drawers pull out freely, spinning wheels turn, and tiny grandfather clocks tick away accurately.

In keeping with his miniature production are the miniature quarters in which Kautter conducts his business. Cramped for space, his workshop is condensed into an 8 by 10-foot area behind his store. The store itself is so tiny that customers have to stand in single file, no more than three at a time. He utilizes every available inch of wall space—even the cubby hole marked "Gents," which he has lined to the ceiling with shelves.

Kautter's power tools include a drill press, wood turning lathe, router, shaper and jig saw. He has an 8-inch circular saw table for which he had a special 1/32-inch saw blade made for inlay work.

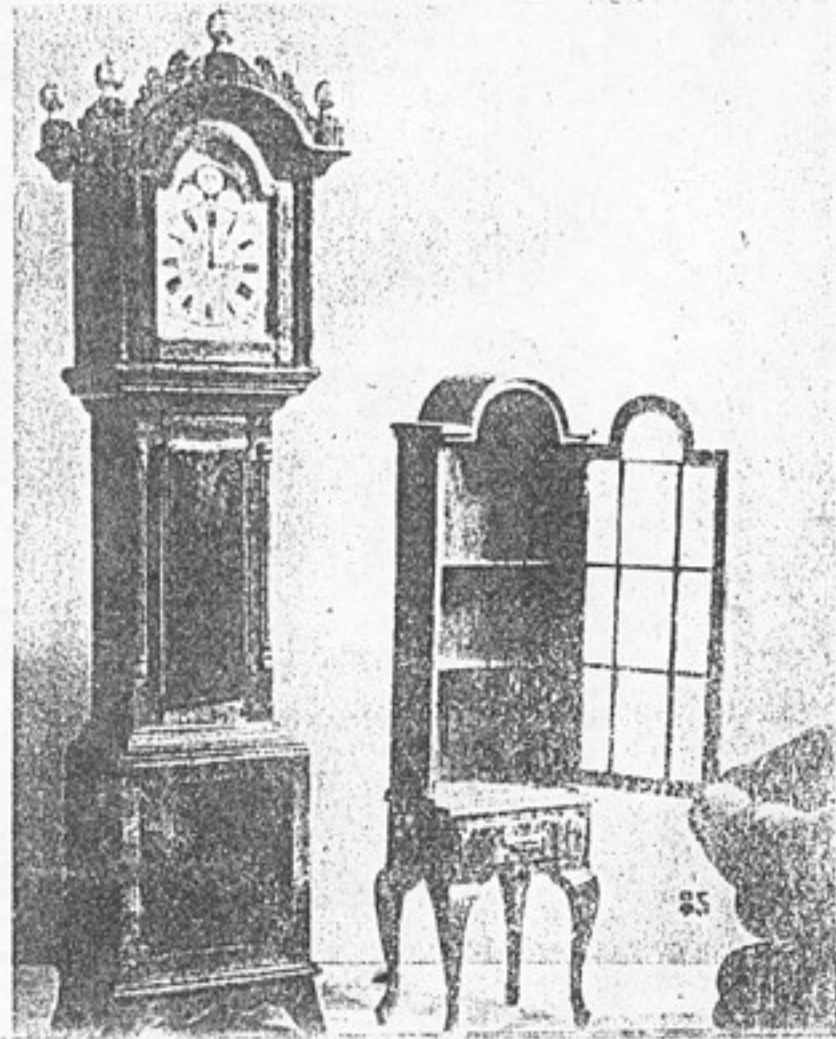
Scorning mass production, he rarely makes up more than six copies of a single piece at a time. It takes him about four days to make the \$145 grandfather clock and three days to turn out a Queen-Anne style china closet which sells for \$30. A fully upholstered Chippendale chair, which sells for \$32, takes him two days to build—six hours alone for the upholstering.

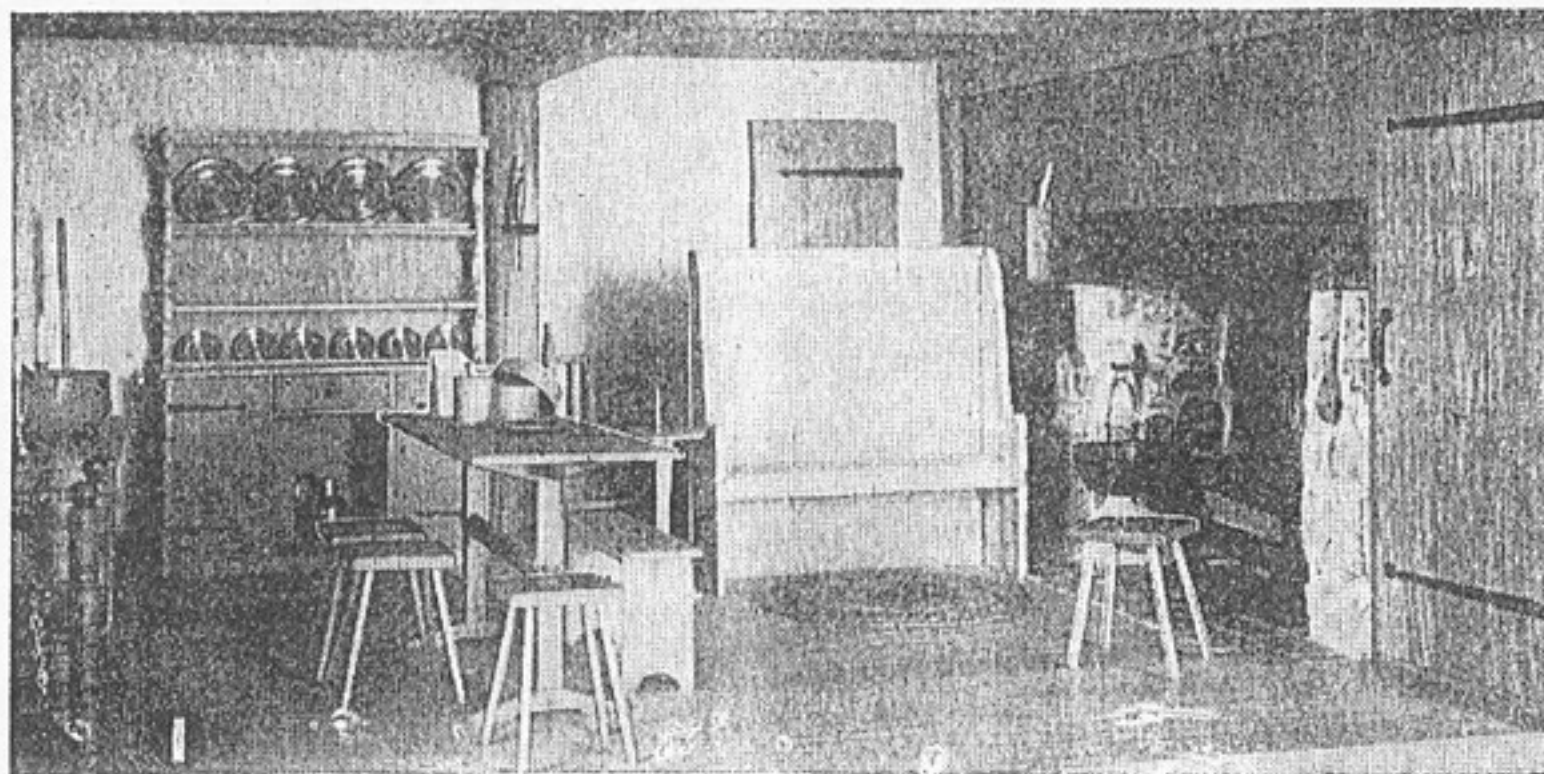
But all this painstaking and time-consuming work seems to be fun for Kautter—he says he relaxes at his job. Even now, he's making plans for larger working quarters—so he can turn out tinier models. •

Old-fashioned jeweler's lathe serves Kautter well. Some single pieces take almost a week to produce.



Grandfather clock, left, is built to a 1½-inch scale. Queen Anne closet, right, to a one-inch scale.





SCIENCE AND MECHANICS FEBRUARY, 1952

Building Miniature Early American Furniture

By WINTHROP PRATT, JR.

Craft Print Project No. 160

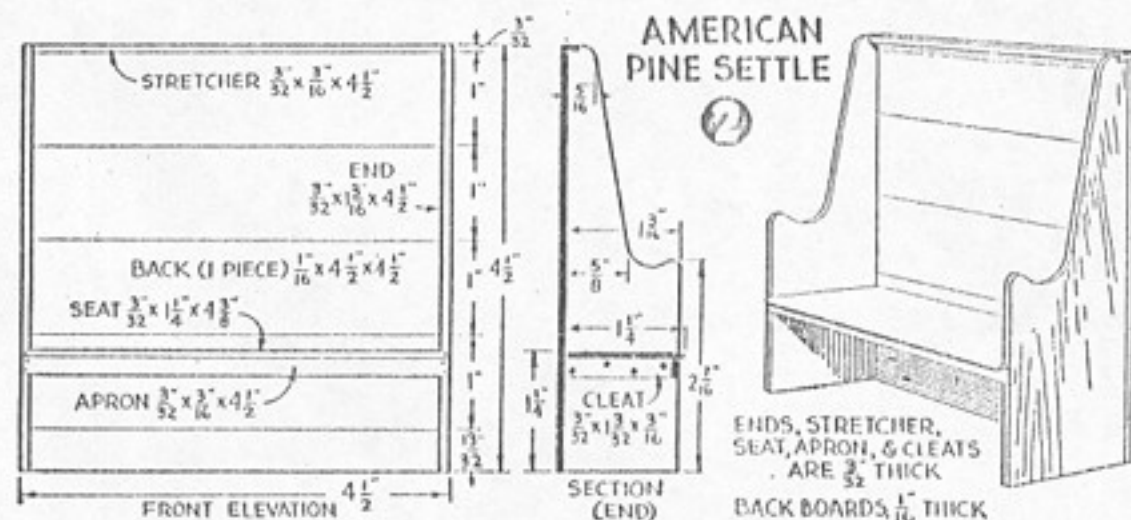
TO BUILD 1 in. to the foot scale models of these 6 authentic pieces of 17th Century Colonial American furniture, you'll need tools and equipment shown in Table A. The wood you use should be from old wooden picture or mirror backs—pieces sawed from discarded drawer bottoms, sides, etc., but select wood with an aged, brownish color. For dowels I prefer birch but chose only the darker colored ones. Of course you can stain these models, but the original pieces were always unpainted so a naturally aged

look is better. To protect against dust and finger marks, rub furniture wax into the raw wood but don't have it shiny.

Let's start with the easily-made old pine settle (Figs. 1 and 2) which looks awkward but was purely functional. It was placed beside the fireplace (Fig. 1) and the high back and ends came right to the floor to keep off drafts. Such settles were usually 4 or 5 ft. high and about the same in length. The seat was about 15 in. wide, and from 15 to 17 in. above the floor; occasionally a cushion was used. A typical settle was built of 1 to 1½ in. thick pine boards for ends, seat, apron and top stretcher, with ¾ in. boards for the back. The seat was usually mortised into the ends, and sometimes projected about 1 in. beyond them on the front edge. Some had an apron (Fig. 2) but others did not. Seat cleats were sometimes used, and you can use these instead of the mortises for support, if you prefer, for your model. On your model make the back of one piece and score it to resemble separate boards, which would tend to shrink and show cracks due to our modern heating systems. Although glue was not used on the originals, it's wise to both glue and nail the small model pieces. The originals were unpainted

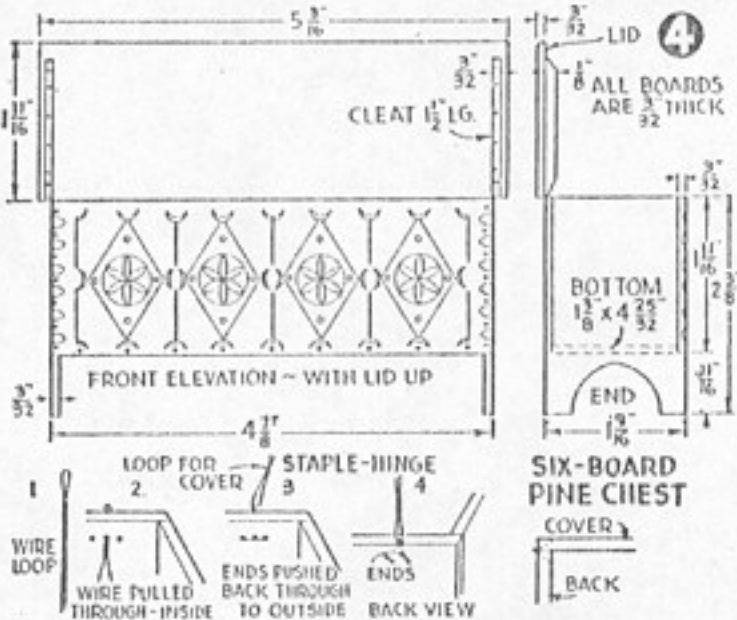
and soon acquired a beautiful toast brown color, so remember to use old wood if you can.

Hold end pieces (Fig. 2) in a vise and saw them out together with a fine fretsaw or jeweler's saw. Cut seat mortises (or put on cleats), make apron and top stretcher exactly the same length, then fit together and fasten seats, cleats, apron and stretcher in that order,



putting the back on last.

The 17th Century six-board chest (Figs. 3 and 4) is another piece you can make easily. These chests, used for storing linens, clothing, etc., varied quite a bit in size and might be from 2 ft. up to 32 in. high and from 3½ to 5 ft. long. Good proportions are more important than actual measurements. Make the height about half again as much as the width, for the ends, and the total length about twice the height. Make the depth of the chest about three-quarters of the total height. You can also make chests like this large enough to use as cigarette boxes or



actual size for storing blankets. Such 6-board chests were usually pine or oak with a pine lid (for lightness); sometimes chestnut or other wood was used. Occasionally corners were dovetailed, and sometimes reinforced at the corners with iron of a "butterfly" shape. Board thicknesses were all about the same, and varied in different chests from ¾ to 1¼ in. depending on the chest size. I used ⅜ in. stock for my model, which is about as thin as practical for such work. Although these chests were seldom painted in the very early days, a design was sometimes "scratched" onto the front board. The one shown (Fig. 4) is an adaptation of an original motif, a bit simplified because of the size of the model. Don't try to really scratch it on a small pine model; cut it in with a sharp knife or leave it unadorned as many were. However, the little half round notches at the corners are decorative and authentic and you can cut these with a round chisel or half-round file.

TABLE A—TOOLS FOR MODEL FURNITURE PROJECTS

6¼ in. Swiss pattern needle files—flat, 3-cornered and ½ round (for cutting mortises, turning chair posts, beveling, etc.) Sharp knife with a thin blade, such as X-acto. Jeweler's saw or fine-bladed fretsaw (optional) No. 76, No. 74, No. 75 and 1/16" drills and pin vise to hold them. Light hammer, No. 00, No. ½, No. 1½ sandpaper, handful of ¼" brads, such as ship modelers and pattern-makers use, ⅜ or ½" lill or ribbon pins. Small lathe and fine dovetail saw (both optional)

Saw out the end pieces together, as you did on the settle. Then cut mortises for bottom board, and cut out along sides for front and back boards. Note that bottom board fits inside of front and back boards. After assembling these parts, fit on the cover, which is flush with the back board but overhangs on the ends and front about 1½ times its own thickness to allow room for end cleats to be nailed on the underside. Mark locations of tiny staple hinges (Fig. 4) on back and edge of cover *with the cover on*, then drill holes (large enough to take a doubled piece of copper wire) diagonally from the corners as shown. Push doubled wire through holes in chest back, then pull from inside until only a tiny loop is left outside. Drill a hole on each side of the wire ends, from inside to outside, then spread wires apart and put ends through each hole to outside. Cut off ends on outside. Now link wire through these loops and push ends through holes in cover edge and pull up so loops are as small as possible. (A little twist permits those in the chest to lie at right angles to those in the cover.) Treat ends the same as in the chest back. Actually the ends were driven into the boards but on this small scale it is better to pull them through.

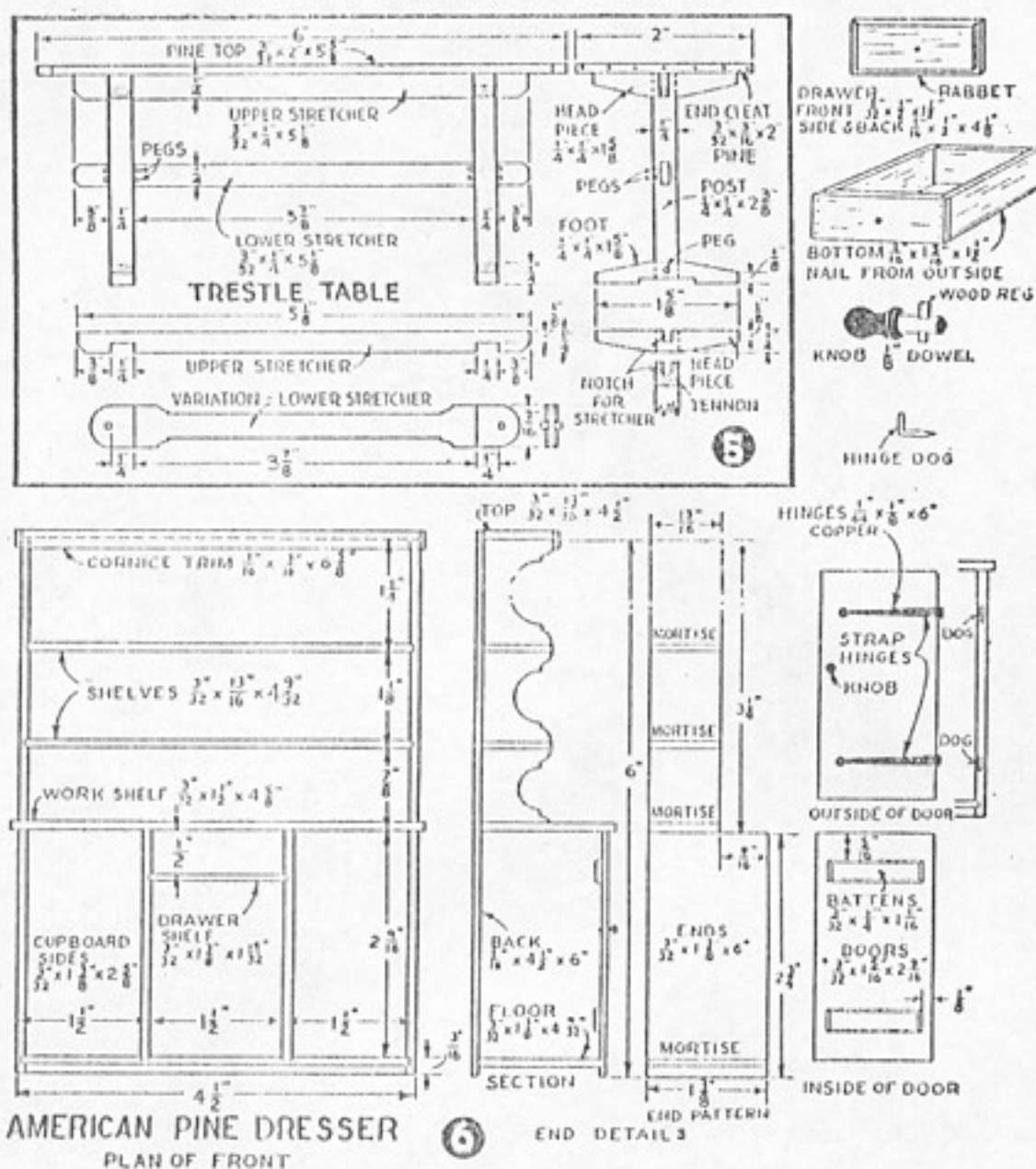
The trestle tables (Figs. 1, 3 and 5) were made

on the knock-down principle, and could be taken apart leaving more space for the housewife in her crowded colonial room. Original pieces are rare and probably not over 50 authentic pieces exist today in the United States. The frames, or trestles, were usually of maple, oak, or some hardwood, with the trestle board on top of pine, often in one piece. Our model combines interesting features of several known examples.

Posts, head-pieces, and feet are cut from $\frac{1}{4}$ in. square boxwood or lemon-wood stock. Make these 2 end frames first. Cut slots for tenons of the posts in head pieces and feet by drilling 2 holes and filing out wood between them with a flat Swiss pattern file. Drill and insert and glue peg through post and tenon. Cut notch for upper stretcher but only $\frac{1}{2}$ as deep as the stretcher width. Next cut out slots in the posts for the lower stretcher. (File out the bottom of the feet after joints are made and glue has set up.) Now make upper stretcher and fit it to head pieces. Put lower stretcher through posts and mark for pegs, making sure posts are exactly parallel when doing so. Drill for pegs and file holes square with square Swiss pattern file. Make pegs to fit these holes.

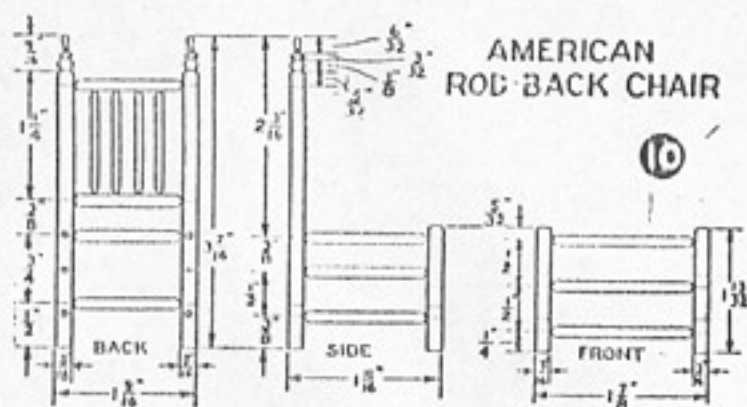
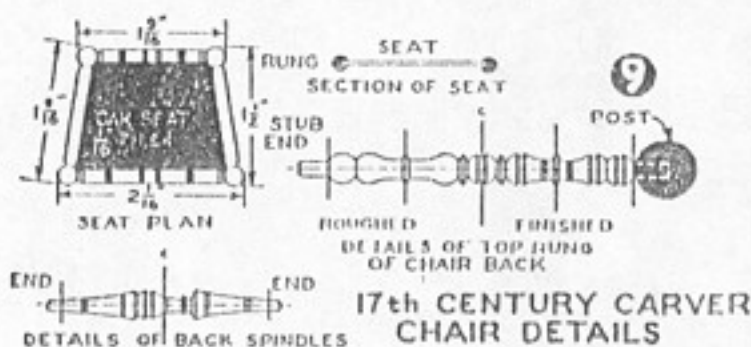
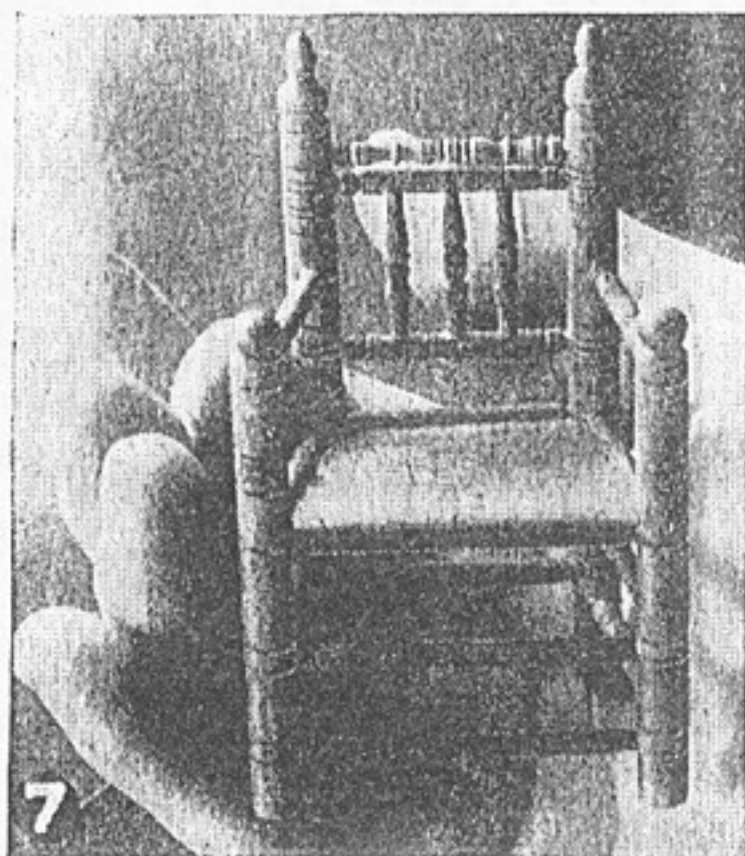
Cut top or trestle board from one piece of pine, square the ends, and glue and nail on the end cleats, sanding them flush with top after glue has set. Glue top to frame. Actually, of course, this top was not attached to the frame, but on a model it is better to do so.

Colonial pine dressers (Figs. 1, 3 and 6) occupied a prominent place in the Early American room, and were often as large as 4 or 5 ft. wide



and 5 1/2 to 7 ft. high, with the back-to-front width of the work shelf running from 18 to 24 in. or so. The design also varied considerably, depending on the skill of the maker, materials at hand, cost,

and size of the room it was to occupy. All had the lower section deeper than the shelved top section, but some had 2 doors and no drawer, and some 3 doors; some had a tier of drawers between the doors, and examples are found with a door on one side and the other side open. Doors and drawer fronts were usually single, plain boards on earlier pieces, but some later ones have paneled doors. Strap hinges, butterfly hinges, H-L hinges, and many other variations were used to hang the doors. Sometimes strips of cowhide nailed on took the place of metal. The long strap hinge is perhaps more typical of the earlier New England dressers with plain round wooden knobs. Three shelves at unequal heights were quite common. The one illustrated is a combination of several of these typical features.



Shelves, floor, workshelf and cupboard walls are mortised together, but you can also glue and nail without mortising if you prefer. Cut side pieces together, make mortises, then make and assemble cupboard walls and drawer shelf. Assemble sides, top, workshelf and floor, put in cupboard unit, and fit molding at top. Fit shelves next. Put on the back boards which is one piece for the model with board lines scored in (these run vertically instead of horizontally, as on the settle).

Now cut out the doors, gluing and nailing battens on the inside. Put nails through from outside and clinch them on inside. Allow $\frac{1}{8}$ in. between ends of battens and door edges. Glue a $\frac{1}{16}$ in. strip on inside of cupboards at knob edge of door for it to close against. Turn knobs from $\frac{1}{8}$ in. dowel so that they project about $\frac{1}{8}$ in. beyond door front. It isn't necessary to put a peg through the shank on the inside, just drill a hole and glue it in. Make door and drawer knobs the same size.

You can cut hinges from $\frac{1}{16}$ in. thick copper. Roll the ends over a nail the same size as the dogs, then shape rest of hinge with a flat file and bevel all edges of outer face to give a thin appearance. Drill holes for nails and lightly countersink with a larger drill so nail heads will seat smoothly. I used lills pins and cut them off on the inside. Hinges should line up on center of battens. Dogs can be made from lills pins. Cut off heads, bend at right angles, then hammer points flat to prevent turning in the wood. Hanging tiny doors like these calls for patience and accuracy but it is not too hard if you use care. Lay doors in place and mark location of dogs at under edge of hinges. Remove, drill and set dogs in with pliers. Hang doors on dogs in wide open position (to clear shelf-edge), then close doors.

Drawers were made as shown in the 17th century. Cut drawer front first and get a perfect fit in drawer opening. Cut rabbets on sides and bottom of front. Measure depth of drawer opening and cut bottom piece shorter by about $\frac{1}{2}$ the drawer front thickness. Glue and nail on bottom to front, then sides to front and bottom. Try drawer in opening, but put knob on first, or you won't be able to get it out easily. Sand until drawer slides smoothly. Put on drawer back, sand flush with sides and bottom and our dresser is finished.

Carver is a name given to a type of chair (Figs. 3, 7 and 8) more or less resembling the Plym-

outh, Mass. original belonging to Governor Carver, and there are many variations. It was perhaps a more common type than the complicated "thrown" or turned Elder Brewster chair. Seats may have been of rush, board, or splint, and rungs more or less decorative in their turnings. Chairs were made with or without arms.

The one reproduced here is a copy of an original in the Museum of Fine Arts at Boston, measured drawings of which were made with their kind permission. The wooden seat's height, 18 in. from the floor, is a bit unusual as 15 in. to 17 in. was more common.

Make back posts first (Fig. 8). Turn ball and acorn finials leaving just enough dowel outside of lathe chuck to work with. Remove from chuck and mark locations of back rungs only. Put in chuck again and lightly score these locations with a threading tool. Remove and drill for back rungs, noting that rung ends are smaller than body of rungs. Mark location of all side rungs, chuck and score these locations but do not drill for rungs now; just prick location of holes with a bradawl. Chuck again, and score ornamental grooves (or omit these if you like). Turn all back rungs exactly equal in length. Cut slot for seat in seat rung with a dovetail saw. Slip rungs in place *without gluing*, and measure for the 3 back spindles' lengths. Make back spindles (Fig. 9), and drill holes for them in their respective

rungs. Slip spindles in place *without gluing* and fit assembly of 3 spindles and 2 rungs into back posts. When sure of a correct fit, remove and assemble back as follows: Glue 3 spindles into their rungs. Glue one side of this assembly into one back post, then glue ends of other rungs into same post. Glue other ends of all rungs into other back post, and lay completely assembled back on perfectly flat surface (such as $\frac{1}{4}$ in. thick glass). Square up whole thing and let dry.

When back assembly is dry, drill holes for side rungs and arms at an angle. Note side rungs are not the same length as back or front rungs. Now make front posts as you did the back ones; then make front rungs, and assemble as you did the back. Make the seat so that it slips easily into slots in seat rungs (trim corners to clear the posts).

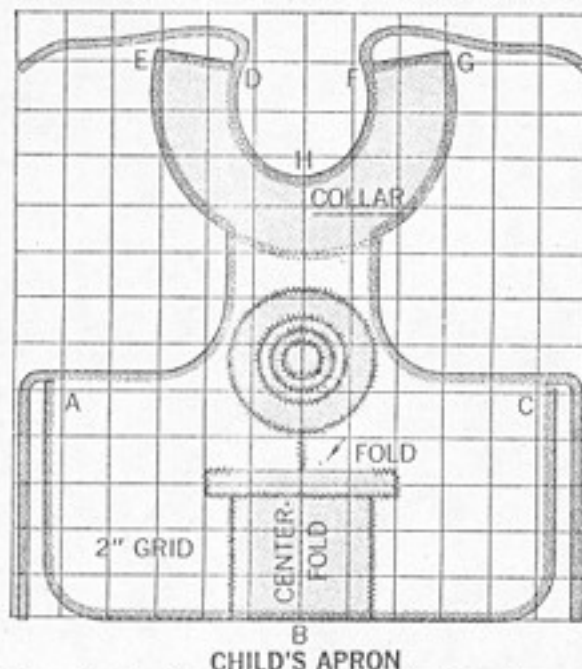
To assemble chair and seat, glue side rungs into back posts, slip seat into seat rungs at sides and back, then bring front assembly onto ends of side rungs, seat rungs and arms. If splint or rush seats are used, seat rungs at sides would come half their diameter higher than those at front and back. Set the whole chair on the glass with a little weight on a thin strip laid across the seat rungs over the seat, and let dry, first making sure posts are vertical. The rod back chair (Fig. 10) is really an armless and much simplified variation of the Carver chair, and is constructed in exactly the same way.



Any budding young cook or artist should wear this gay colorful apron with pride. The flowerpot doubles as a handy pocket

Apron for a young cook

The three-year-old in our picture wouldn't hear of taking on any cooking or coloring project without her bright-colored apron. Her mother, who designed this simple pattern for it, used a zigzag machine stitch for the appliqué. She cut each appliqué fabric with an extra $\frac{1}{2}$ -inch margin along the outlines to be appliquéd, then basted fabric to apron, stitched over the outline, and trimmed away the excess fabric. To make a similar apron, you'll need $\frac{3}{4}$



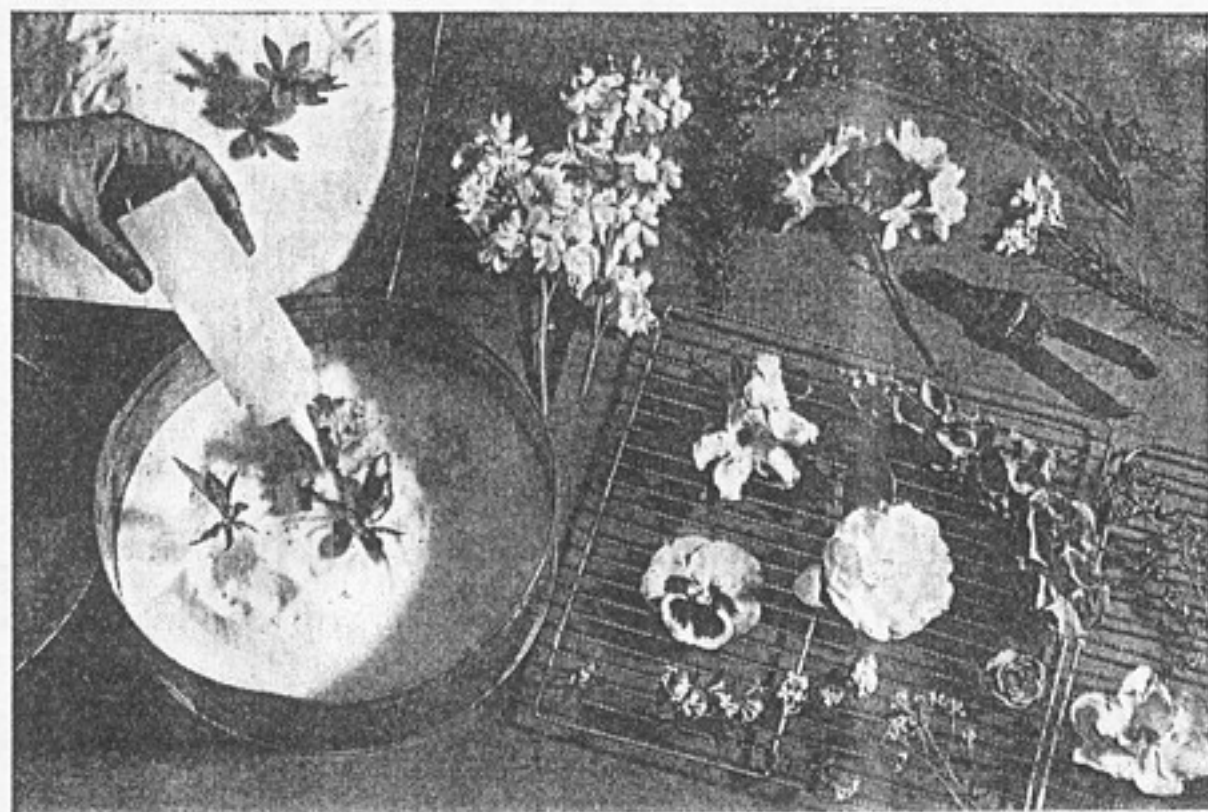
Gray shades indicate appliqué, bias tape. Zigzag lines indicate a zigzag machine stitch for appliqué; follow lines carefully

yard of sturdy fabric for the apron; a 10 by 20-inch piece of fabric for collar and flowerpot; fabric scraps of contrasting colors for the flower (biggest flower circle is 6 inches in diameter); and about $4\frac{1}{2}$ yards of bias tape.

Cut apron fabric along outline of the entire apron as shown on the pattern. Cut appliqué fabrics with an additional $\frac{1}{2}$ -inch margin around each outline to be appliquéd. Cut collar; cut two to four flower circles of diminishing sizes; and cut flowerpot 1 inch longer than shown on the pattern. Fold pot rim down 1 inch over top of pot into position shown on pattern; press rim and stitch to pot (see pattern).

Appliqué pot to apron; leave a $5\frac{1}{2}$ -inch opening at top for pocket. Appliqué flower circles to apron. Fashion stem by making a zigzag stitch from bottom of flower to 1 inch underneath pot rim. Attach bottom of collar to apron.

To bind raw edges of apron, sew $1\frac{1}{4}$ yards of bias tape from A to B to C. Cut two 1-yard lengths of tape; sew one from D to E to A, the other from F to G to C; leave two strips, each about 10 inches long, at points A and C for waist ties, and continue stitching edges of tape together to finish ties. Stitch 1 yard of tape from D to H to F; leave two strips, each about 10 inches long, at D and F, and stitch edges of tape together to finish ties.



Steps in drying flowers: upper right, freshly cut blooms ready to be dried; at left, flowers being covered with silica gel; on rack at lower right, some flowers already dried

SUNSET JUNE 1962

How to confound nature

The art of preserving flowers is getting easier all the time

Preserving flowers for use in permanent bouquets, flower pictures, and the like is not a new idea—it dates back to the time of the Egyptian Pharaohs. But there are constant improvements and innovations in the techniques of drying to retain as much of the original shape, form, and color as possible.

Hanging flowers upside down in a warm, dry place is one of the easiest ways to dry them, but is satisfactory for only a limited number of kinds. Covering flowers with sand, cornmeal, borax, or mixtures of two or more of these mediums has been successful in varying degrees with flowers that do not respond well to the hanging method.

Recently another material has come to the attention of the flower arranger for use in drying and preserving cut blooms. This material is silica gel—an odorless, inert desiccant used for many years in potato chip and cracker boxes to keep the contents crisp, and more recently as the base for a non-toxic insect powder. When the silica gel is dry, this force is very strong and moisture is drawn from flower cells rapidly. The flower drying process uses two sizes of silica gel mixed together: very fine, white, sand-like particles; and larger, bright blue indicator crystals that turn pink when filled with moisture. Because of its fineness, light

weight, and quick drying action, silica gel shows great promise for flowers not preserved successfully by other methods. You'll have a lot of fun experimenting with this material. Early last winter we started with a rose, some chrysanthemums, violas, and a spike of snapdragon. This was just a teaser. As the spring flowers made their appearance, we tried them, too. Daffodils came out perfect, so did pansies, white camellias, and lily-of-the-valley. A few of the very thin petalled



Only the wired stems reveal the fact that these daffodils are dried. Each flower looks as fresh and bright as when cut

blooms such as brodiaea and oxalis were less satisfactory, but this just whetted our appetite for further experiments.

Our best results were with the pure colors—clear pink, yellow, blue, orange—and with white. The reds that contain purple tend to turn blue; the bronzes turn brown. Green foliage—with the exception of maidenhair fern—becomes dull, but the silvery gray leaves of dusty miller remain quite true to color.

WHICH FLOWERS DRY BEST?

Here is a list of the flowers we dried in silica gel, with comments on the results: *African daisies*. Rays take on a transparent quality. Petals must be glued.

Basket-of-gold alyssum. Retains good yellow color. Quite a bit of shrinkage in flower size if left in silica gel too long. Needs only four days drying time.

Azalea. We dried whole stem with leaves and flowers. Holds form well with stamens erect. Red turns dark; white stays pure.

Bells-of-Ireland. Bracts have to be glued back on stem. Retains green color well.

Brodiaea. Too thin and fragile; petals become translucent when dried.

Calendula. Cover carefully with desiccant, since rays are not firmly attached. Holds color well. Rays require gluing.

Calla lily. Dries very successfully if you lay cup-like bract flat, sifting silica gel around central flower spike. Bring lily to surface after four days; keep base submerged another three.

Camellia. Excellent results with white; reds tend to blue. Foliage dulls. Use only fresh blooms; bruised flowers will rot before they dry.

Ceanothus. Dries very well in three to four days. Blue color fades slightly. Foliage dulls. Dry flower clusters in upright position. May be best to remove leaves before drying.

Chrysanthemum. Rays tend to drop when dry. Fluff mixture around bloom to maintain form.

Daffodil. The perfect flower for drying. Holds color, retains form well.

Diosma. Entire twig with leaves and flowers dries perfectly, holding form and color well.

Dutch iris. Requires large container for drying. Keep covered for at least eight days; difficult to cover again if removed from desiccant. Blue iris holds color well.

Dusty miller. We dried foliage only, with good results.

Flowering fruit trees. We dried blossoms on twig. Excellent results with three or four days' drying.

Fuchsia. Holds form and color well; slight wrinkling on sepals if left in desiccant too long. Keep dried blooms enclosed in container or store in extra-dry atmosphere, since they tend to re-absorb moisture from air readily.

Gladiolus. Pinkish orange color holds well; petals become translucent.

Heather. Flowers hold on stem well; leaves drop.

Hellebore. Excellent results with Lenten rose. Retains good color and form.

Hyacinth. Mixed results. Some were satisfactory in four days (both clusters and

individual flowers); others weren't dry in seven days—stem collapsed, flowers shriveled.

Leptospermum. Dries very well. Holds foliage; retains dark red color well.

Lily-of-the-valley. Whole spray dried well. Very delicate looking.

Osmanthus. Used the entire flowering twig. Flowers dry pure white, retain slight fragrance.

Pansies. Good results in three to four days. Flowers dried longer lose their velvety sheen.

Primrose. Disappointing. Reds and blues become muddy and dark.

Rhododendron. We used a white bloom with pinkish cast. Blooms dried perfectly, with stamens remaining erect.

Rose. Red tends to turn blue; white and yellows hold well. Pink baby rose holds form and color well. Petals of large flowered varieties will drop unless you secure them with glue or hot wax. Dry flower when only partially open; it opens wide in the desiccant.

Saucer magnolia. Holds form well; but streaks of brown appear at base of petals, base color becomes muddy.

Snapdragon. White, pink, and yellow flowers retain colors well. For best results distribute desiccant evenly around and inside each flower.

Stock. Dry individual flowers, then wire together. White, pink, lavender colors hold well; purple darkens.

Viola. Both yellow and blue hold color and form well.

BUYING SILICA GEL

You can buy silica gel in 1, 1½, and 5-pound cans. One West Coast distributor sells a kit that includes all the equipment you need: 5 pounds of silica gel, with a plastic storage bag and wire ties for sealing; a can for drying the flowers (9½ inches in diameter by 3¾ inches deep); a plastic squeeze bottle for distributing the silica gel evenly between flower petals;

and a small camel's hair brush for removing fine particles that adhere to the petal surface after the flower is dry. This kit sells for \$8.95.

CUTTING FLOWERS

Gather flowers for drying after dew has dried on the petals. Select well formed, unblemished blooms; many flowers continue to open after they are placed in the silica gel, so try to take them just before they open wide. Don't collect too many flowers at one time, as some may wilt before you are able to get them into the desiccant.

PLACING THE FLOWERS

It's best to put only one kind of flower in a container, because different kinds require varying lengths of time to dry. Use a container that has a tight-fitting lid, making it relatively airtight. Candy tins or coffee cans work quite well.

Spread 1 to 1½ inches of silica gel on the bottom of the drying box. Poke flowers with about 1 inch of stem into the desiccant, faces up. With your hand, a plastic squeeze bottle, or a funnel of paper, carefully pour the silica gel around and between the petals. Work from one side to the other, first building up a mound of silica gel under a petal to support it, then gently filling in over the top. (Be careful not to fold back or crinkle petals.) When the petals are completely covered, close the container tightly; keep it upright and undisturbed until the drying process is completed.

HOW LONG TO DRY FLOWERS

Most garden flowers take about a week to dry thoroughly in silica gel. One person who has been preserving flowers by this method for a year, said she had best results when she uncovered the tin, quick drying petals after three or four days, leaving the fleshy, slower drying base in desiccant for an additional three or four days. Flowers uncovered in two stages seem to crack, wrinkle, or shrink less; they also hold their petals better and require less gluing.

The amount of moisture in the silica gel will affect the drying time. When completely dry, the indicator crystals are bright blue; as they absorb moisture, they turn pink. To make the silica gel reusable, place it in an oven at 250° until the indicator crystals change back to blue. (The white particles may take on a brownish cast, but this does not affect usefulness.)

CARE AFTER DRYING

When flower petals are crisp, slowly pour the desiccant out of the drying box,

gently lifting out the flowers as you uncover them. Some of the fine petalled flowers tend to shatter when dry, so before you do anything else to them, use a toothpick to guide a drop or two of white glue or hobby craft cement to the base of each petal. Set the flowers on a cake rack to dry for about five minutes, then use a soft bristled brush to dust off silica gel that clings to the blooms.

Wire stems on the flowers you wish to use in arrangements. A 22-gage florist's wire works well on heavy headed blooms such as daffodils or roses. Use 26-gage wire on violets, pansies, and other delicate blooms. An 18-gage wire is good for reinforcing and lengthening stems.

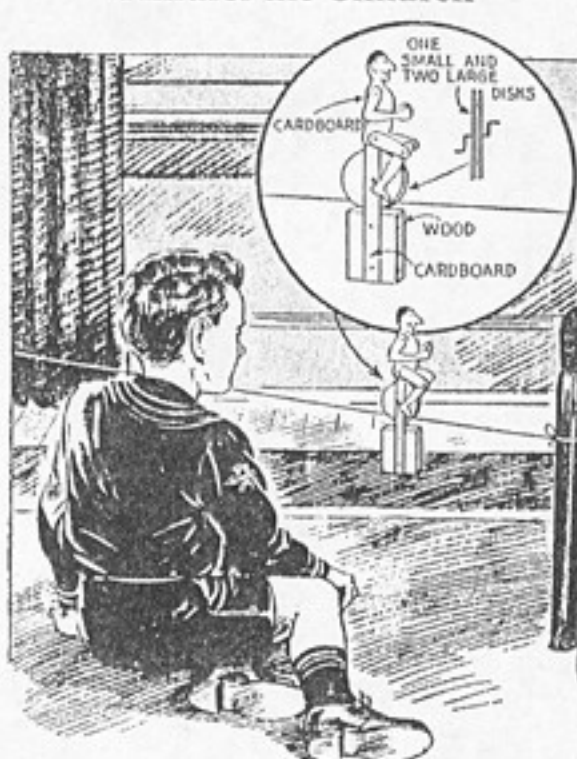
STORING DRIED FLOWERS

Store dried flowers in airtight canisters or glass jars until you are ready to use them. A little silica gel in the bottom will absorb any moisture that may get in.

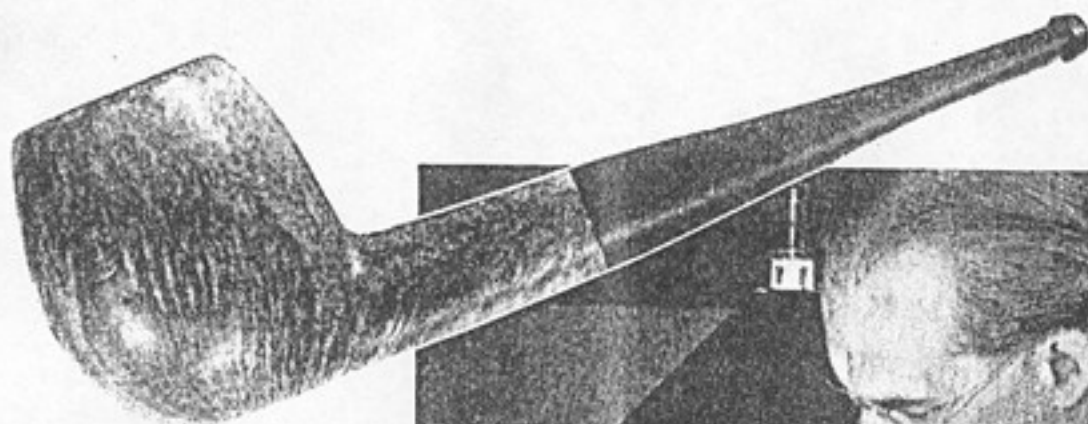
Dried flowers should last indefinitely with careful handling. Sun will fade them rapidly, so keep arranged bouquets in subdued light to retain colors.

POPULAR MECHANICS 1942

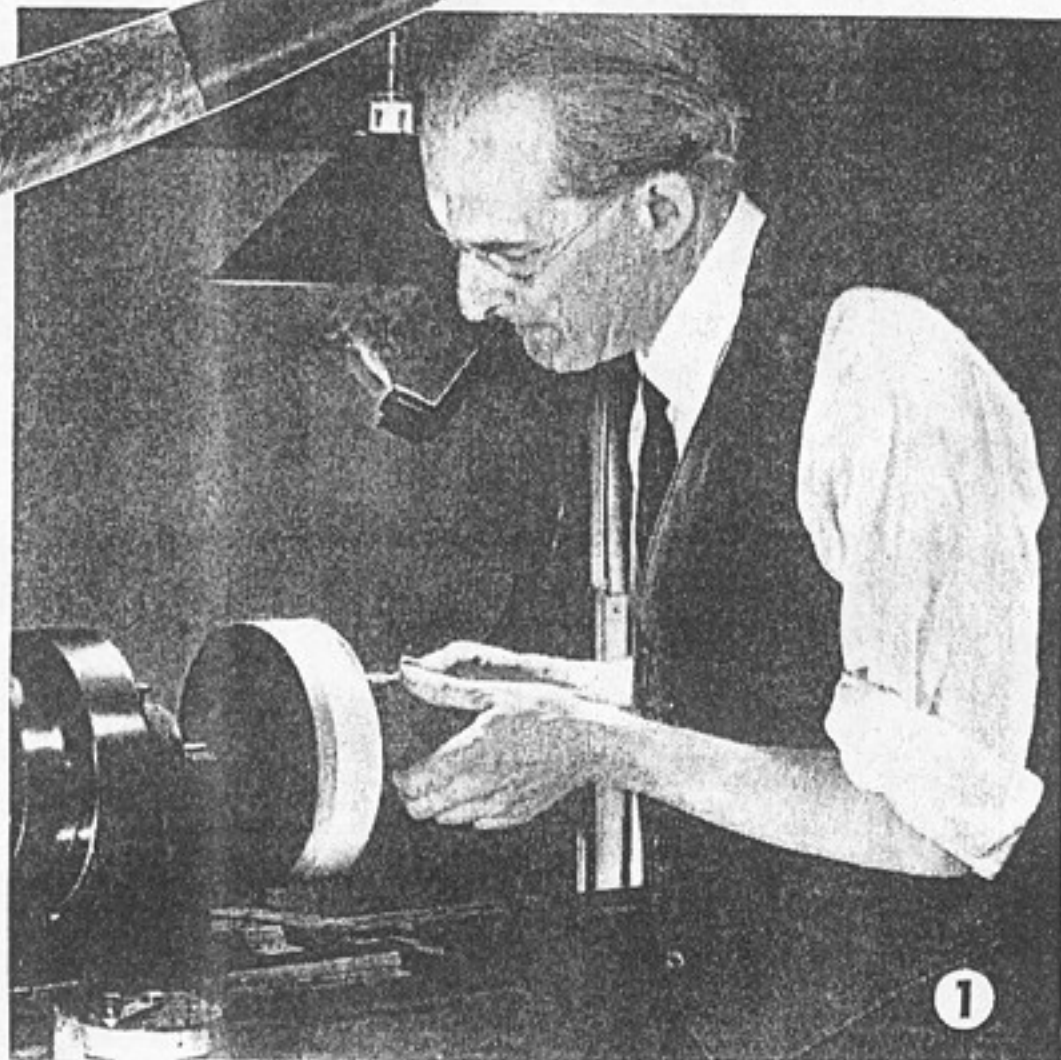
Easily Assembled Rope Walker Amuses the Children



When you are looking for something to amuse a small child, try this tight-rope walker. It is constructed of cardboard in a few minutes. Each arm is cut in one piece and pivoted to the body, while each leg is in two pieces and pivoted at the knee and hip. The disk, which runs on a taut string, has an axle of the bicycle type, the feet being pivoted to it. A block of wood is used as a counterweight to keep the walker upright.



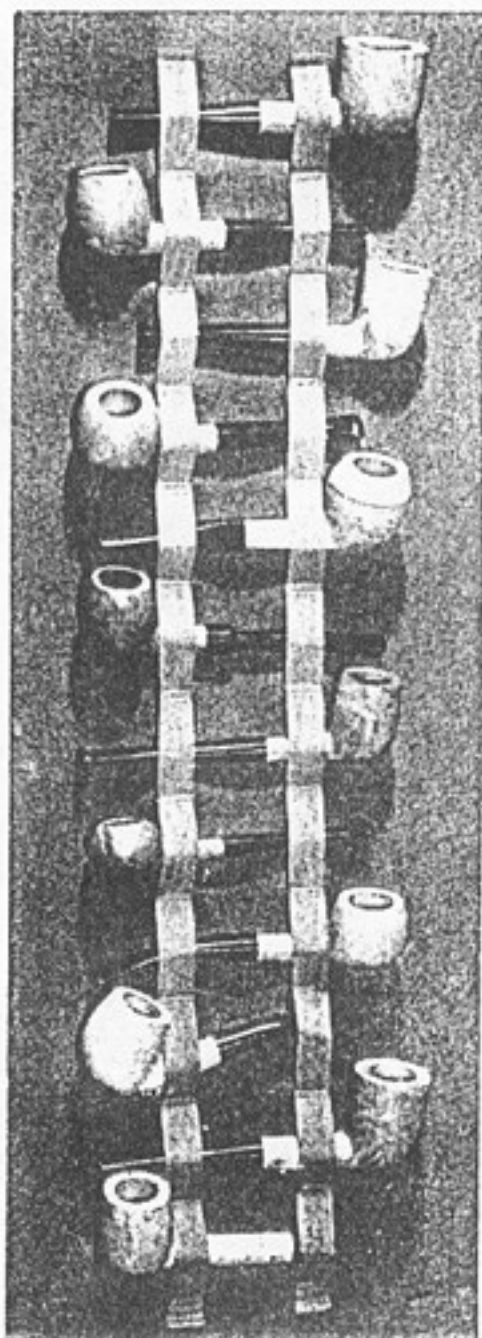
His brier selected, Mr. Graham, at right, squares two sides of the block as the first step in turning one of his beautifully finished pipes. Several of the designs he makes are shown in the photograph below, and one of decoratively grained brier above. He works in a shop at home, and uses an ancient lathe



POPULAR SCIENCE NOVEMBER, 1941

Pipe Making

Joseph W. Graham, whose hobby is now a business, shows how the home craftsman can turn a block of brier into a handsome, sweet-smoking pipe



PROBABLY every craftsman who is a pipe smoker feels at some time or other the urge to try his hand at pipe making. It was such an impulse that started Joseph W. Graham, of White Plains, N. Y., in the hobby that became his business in 1937, when he was unable to find work in his capacity of production engineer. In the tiny workshop on the second floor of his home, Graham has turned out as many as 3,000 pipes in one year, all of them made on a huge, ancient lathe of a type patented in 1874. Despite this respectable volume of business, he still uses home-made chucks and other improvised equipment.

With such simple accessories as he can devise for himself, any lathe owner can make pipes for his own use and as gifts. The beginner will do well to copy a straight-stem

pipe for his first attempt, calipering the dimensions directly from it. Later on, he can experiment with designs of his own or attempt more difficult shapes. Graham rarely uses drawings or templates except for special models, but works from samples when he makes his regular styles.

The first step after selecting a brier block is to square up at least two sides of it. This can be done quickly on a disk sander, as shown in Fig. 1. The surfaces should be flat for accurate chucking.

Next, the block is carefully marked as in the first drawing. A square will serve, but the simple jig illustrated speeds the work when several pipes are to be made.

A special pipe-maker's chuck, a four-jaw independent chuck, or a homemade one such as Graham uses (Fig. 2) is needed to mount the block. A plain or a slotted faceplate can be adapted to the purpose by fitting it with four studs having pin screws.

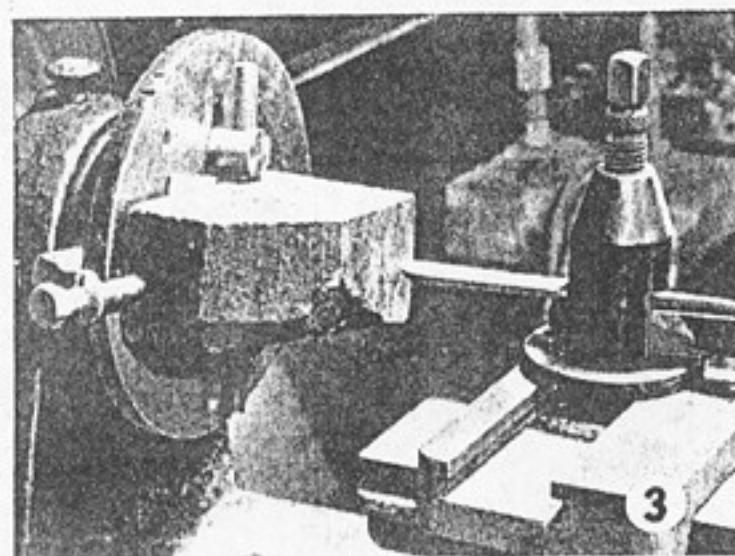
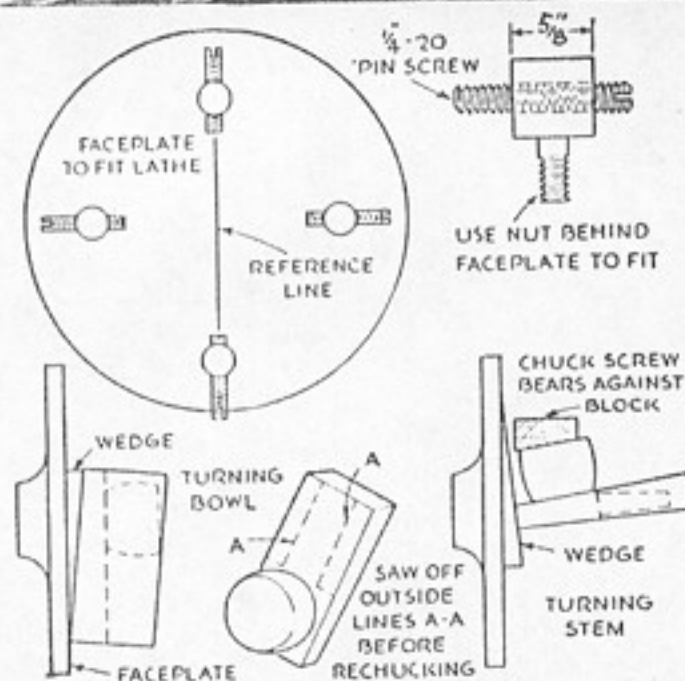
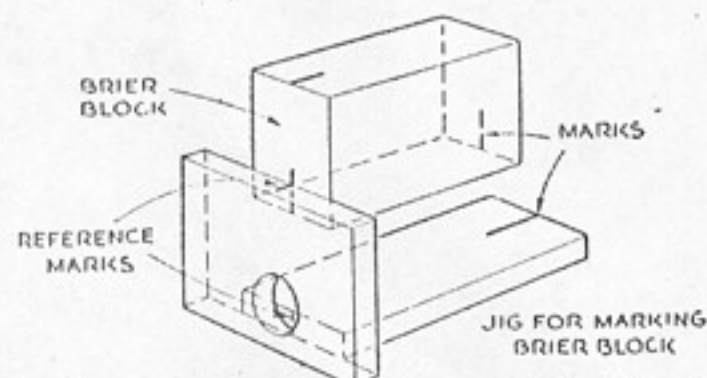
The block is chucked with a hardwood wedge between it and the faceplate as shown in Fig. 2. This wedge produces the characteristic "taper" or slant of the bowl that lends character to the pipe. The amount of taper may vary with style, but a pipe with none at all, that is, with the bowl at 90 deg. to the stem, would have an odd, unsatisfactory appearance.

Mount the block with its center line on the diameter of the faceplate, which may be marked to facilitate alignment. Tighten the pin screws or chuck jaws and check them occasionally during turning to make sure they do not work loose.

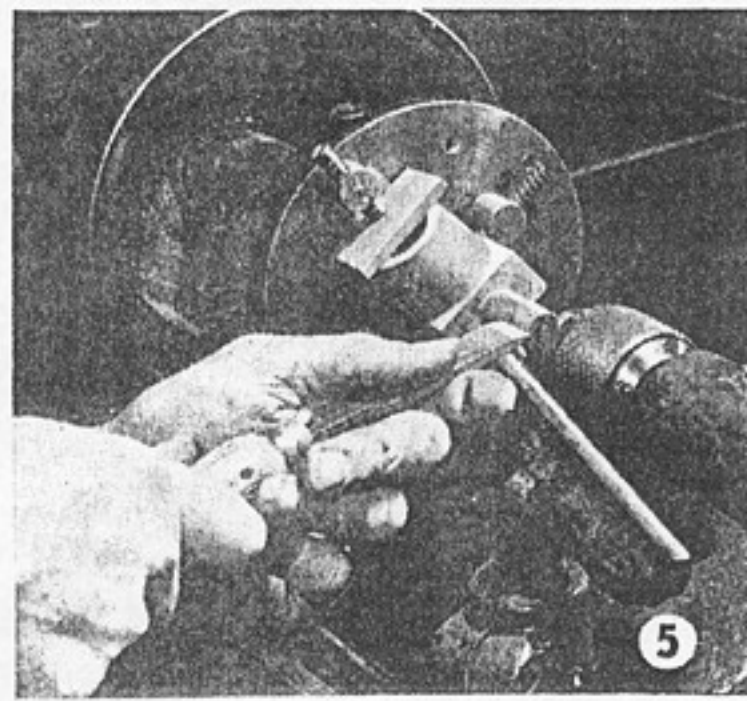
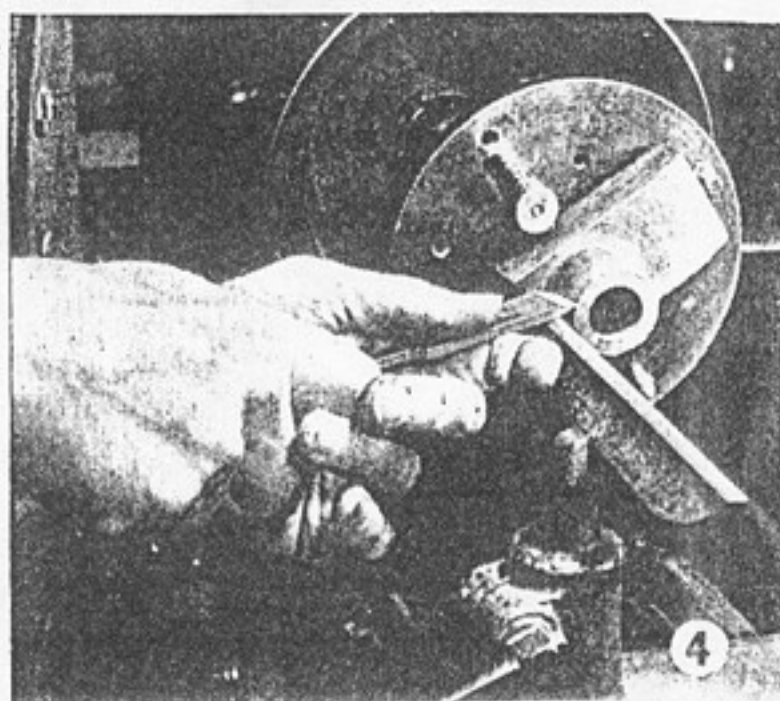
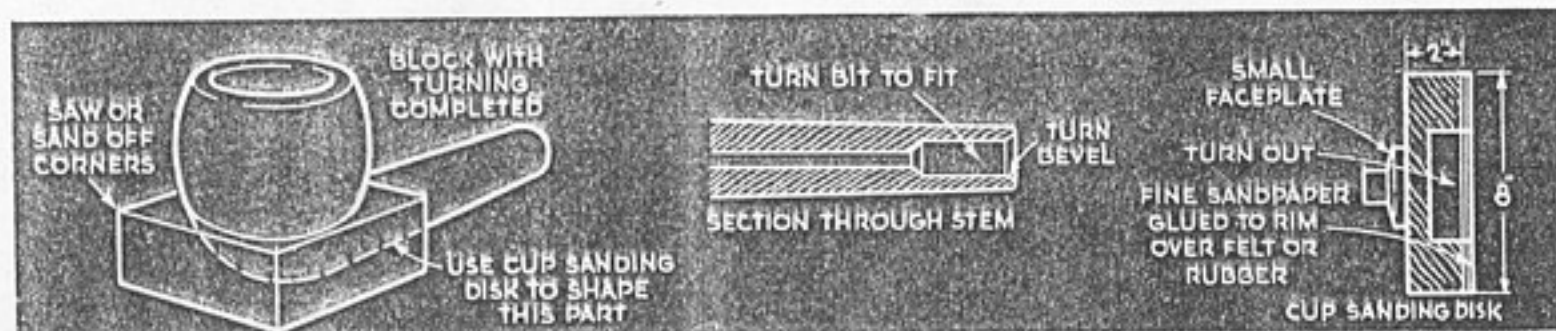
The hole in the bowl is turned out first. It may be started with a $\frac{1}{2}$ " drill bit and finished to size and shape with a special tool such as is shown in Fig. 3. This was ground from an old flat file and sharpened to a razor edge. A scraping cut is used in all turning operations, the tool edge being set on the center line of the lathe spindle.

The same or a similar tool is used in the slide rest to rough-turn the outside of the bowl as far down as possible. The unturned part of the block must be left thick enough to allow turning the stem from it. When much material is to be turned down, Graham prefers the slide rest, as hand-held tools are more likely to "dig in" and tear the fiber of the tough brier.

However, the final convex shape of the bowl is produced by turning it down with a tool held by hand on the conventional tool rest. Figure 4 shows this step, as well as the shape of the block at this time. Either a conventional skew chisel or one ground from a file may be used, but the cutting edge must be razor keen, for upon it depend the finish and perfection of the pipe. If the turned surface is rough, the tool is not



SECTION  TOOL FOR TURNING INSIDE OF BOWL



sharp enough. Graham whets his tools on a very fine Arkansas stone, using oil, and hones them on a piece of leather to which a little optician's rouge is applied.

When the bowl has been shaped to your liking and its top turned square, the block must be rechucked as in the drawings and in Fig. 5. Note that the same wedge is used again, this time under the remaining portion of what was the end of the block, and with the thin end under the turned part of the bowl. A second but heavier wedge-shaped block is inserted between the top of the bowl and the chuck screw bearing against it. Be sure to align the block with the original marks so that these lie along the diameter of the faceplate. Failure to do this will result in bowl and stem being off center.

Using the tailstock chuck, bore a 9/64" hole through the stem portion into the bowl. Then counterbore with a 9/32" drill to a depth of about 3/4". If a filter is to be fitted, the original hole is counterbored twice. Face off the end of the stem portion and turn out the short bevel, which may be formed quickly by holding a countersink against the stem face by hand.

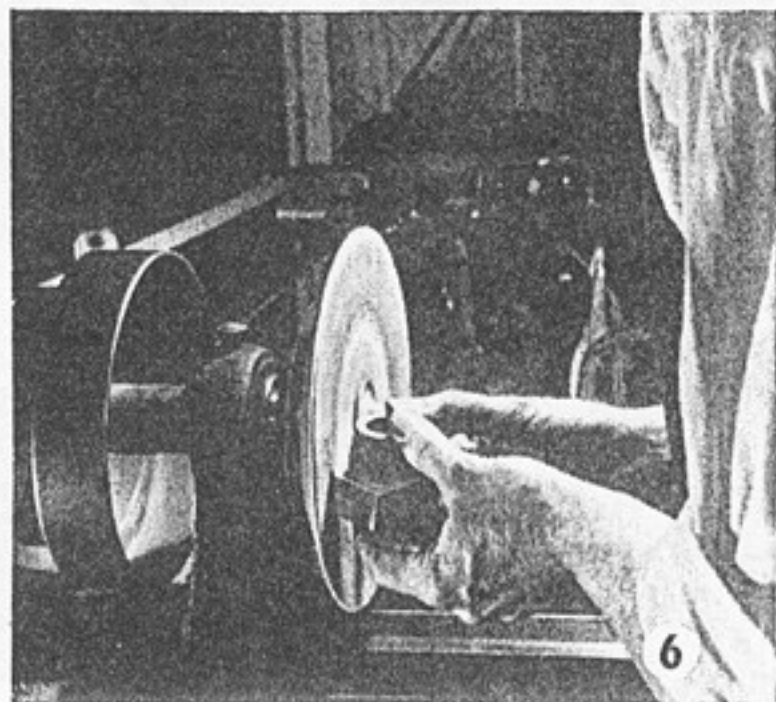
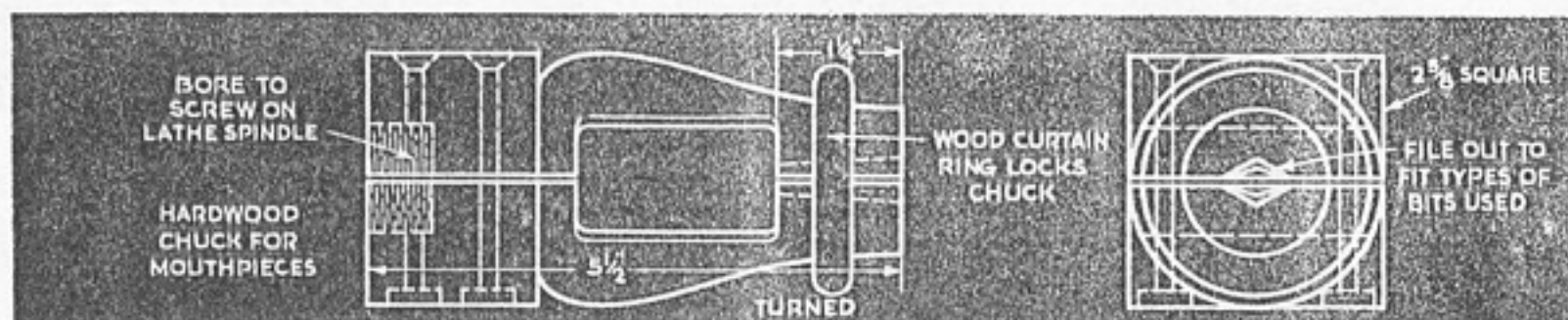
A piece of 9/32" rod is inserted in the tailstock chuck and run into the stem to serve as an arbor while the outside is being turned. Use the slide rest so far as possible, finishing the stem to the desired taper with a hand turning tool. If the maker prefers,

the shoulders of the stem piece may previously be sawed off as indicated by the dotted lines A-A in the drawings so as to leave less stock to be turned down.

Shaping the bottom of the bowl, and the portion that joins it to the stem, is a hand operation calling for skill and a practiced eye. The excess stock is removed on a sanding wheel (Fig. 6). Graham's is a wooden disk with a nut at the center to secure the No. 2 garnet paper, which is not glued or otherwise held to the disk at any other point. He has found that such a loosely held disk conforms itself to the rounded shape of the bowl and removes material speedily without causing flat spots such as occur when the abrasive paper is cemented fast.

For the final shaping of the inner part of the bowl nearest the stem, a cup sanding disk will be necessary. This can be made on the lathe from a glued-up blank, the center being turned out to a depth of about 1 1/2" as shown, and a thick layer of felt cemented to the broad rim. A ring of fine sandpaper is glued to the felt.

The mouthpiece is turned in a special chuck to fit the stem. A negative rake is used on the tool, which is held in the slide rest as in Fig. 7. Stem and mouthpiece are then sanded to a perfect joint on a convex, felt-backed disk covered with No. 280 or No. 320 silicon-carbide paper (Fig. 8). Any slightly roughened parts of the bowl may



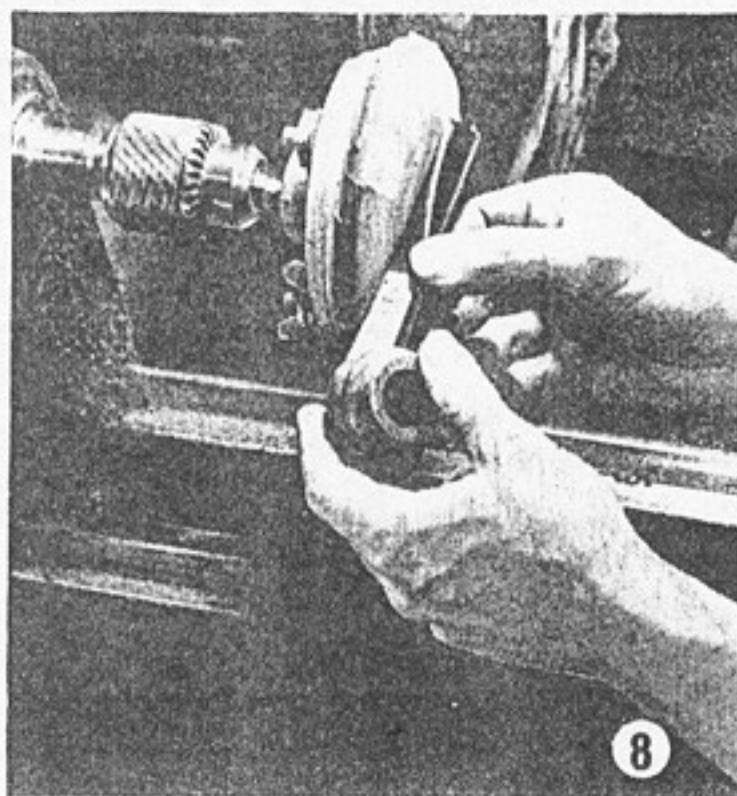
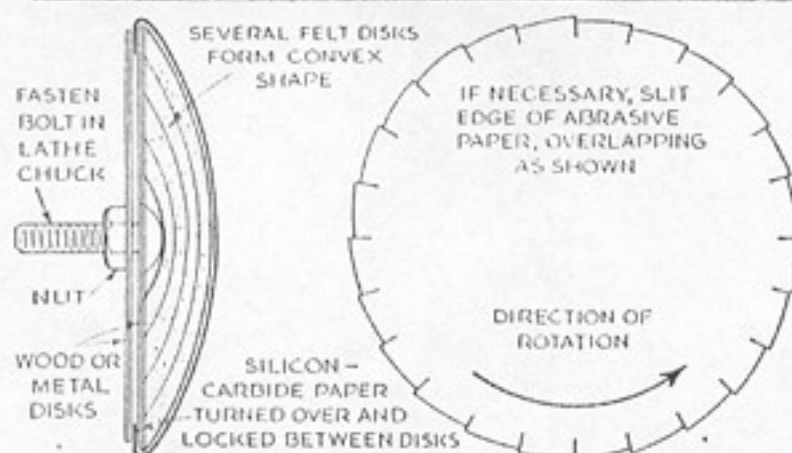
also be sanded smooth on this wheel.

For a high polish, Graham next buffs the brier on a large cotton wheel charged with tripoli, the proper grade of which is best learned by experiment. Final polishing is done on a second uncharged wheel, but if desired this may be used with carnauba wax for a high-gloss finish.

Graham uses no stains, varnish, or other finishes on his pipes, which color as they are smoked to a rich and pleasing patina. They take on a deeper tone also if aged for several months. On light-colored brier, the grain may be brought out by rubbing the pipe with linseed oil after buffing with tripoli. Lay it aside for an hour, then re-buff lightly and polish on the second wheel.

For custom-made "church warden" pipes and others of unusual design, Graham turns mouthpieces out of hard-rubber rod. These are sanded smooth with silicon-carbide paper, buffed with tripoli, and polished as described. Curved mouthpieces are shaped with the fingers after they have been carefully heated above a gas or alcohol flame.

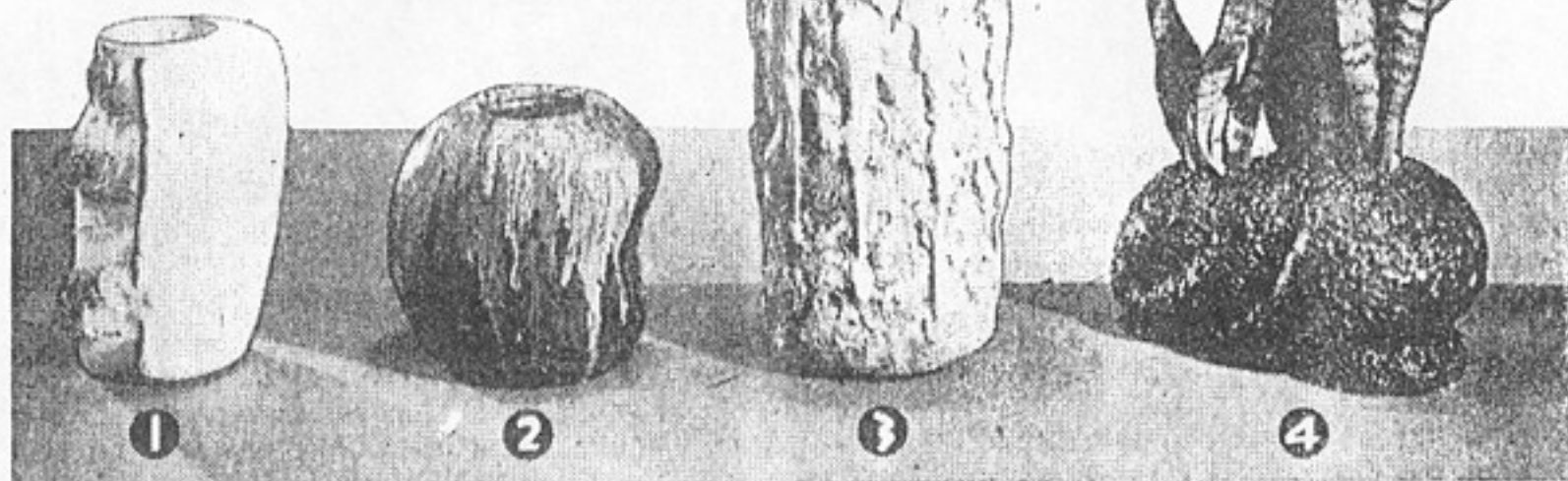
Because of conditions abroad, the importation of brier root has been seriously curtailed. This has led to a search for substitutes. Hickory, maple, mountain laurel, and birch have been used, as well as ebony, rosewood, olive wood, and the burls of manzanita and wild lilac.



Sculptured Plaster Vases

An interesting one-evening project that will tickle your imagination

By RICHARD B. RUSH



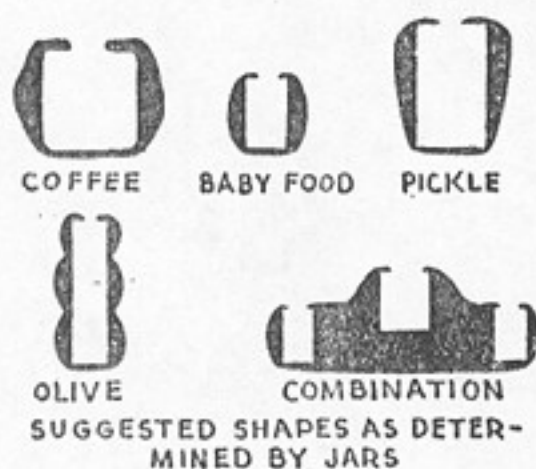
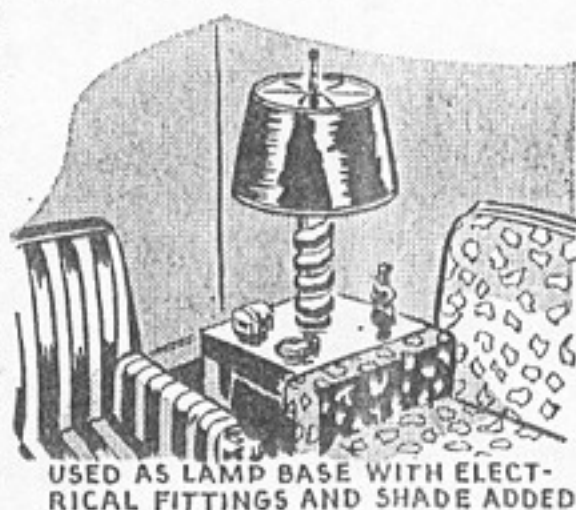
Left to right: (1) cutaway of finished vase, showing how fiber base aids in holding plaster to glass jar; (2) small vase, built around mustard jar, which is notable for its line, coloring, and texture; (3) light sandpapering smoothed the top of this tall vase after thin plaster was allowed to drip down sides for a candle effect; (4) three baby food jars formed the base of this multiple vase. After design was cut to shape with a pocket knife, finish was stippled with a brush dipped in stiff plaster mix, then shellacked and lacquered.

USING a glass jar as a base, it's a simple matter to start and finish an attractive vase, complete with hard glazed finish, in a few hours. What's more, this sculptured vase requires no heating, firing, or glazing, and can be put to use the moment it is finished.

Materials and tools needed are both simple and easily obtainable. You'll need: a glass jar of any size or shape, preferably a small one for your first attempt; five pounds or so of plaster of Paris; a handful of fiber, or a few strips of burlap or cheesecloth several inches wide and a foot long; orange shellac; paint. A square of oilcloth on which to work will protect the top of your working surface. The tools you will need are: a mixing bowl for the plaster; a large spoon; a large spatula or putty knife; and a jackknife. If you would like to experiment with an interesting texture on the finished vase, a broken power hacksaw blade makes an efficient finishing tool.

To $\frac{1}{2}$ pint of water in the mixing bowl add

about $\frac{1}{2}$ pound of plaster of Paris, stirring continuously until it reaches a thick creamy consistency. Dip the fiber or the cloth strips in the wet plaster. When thoroughly saturated, they are ready to be applied to the jar. Make a tight loop around the neck of the jar, just below the rim; then spiral the cloth toward the bottom, finishing with an extra loop, so that the cloth binds firmly upon itself. This cloth-and-plaster



base is the secret of a sturdy and permanent plaster vase built around a jar. It will stick tightly to the jar without cracking or expanding; and it furnishes a firm, non-slip foundation for subsequent coats of plaster.

When the plastered cloth or fiber has dried around the vase (in about a half hour) mix a second and thicker batch of plaster in a somewhat larger quantity. With your spoon place it around the neck of the jar and let it dribble freely down the sides. Scoop up the excess from your oilcloth working surface and apply that to the sides of the vase also. Since plaster of Paris hardens rapidly, continue working as fast as possible with the spoon. When the mixture in the bowl becomes thicker, switch to the spatula, and build up more plaster on your vase on the places called for in your design. If you've underestimated the quantity of plaster you need, mix more. Never attempt to thin plaster which has begun to set, however. Throw it out and start a new batch.

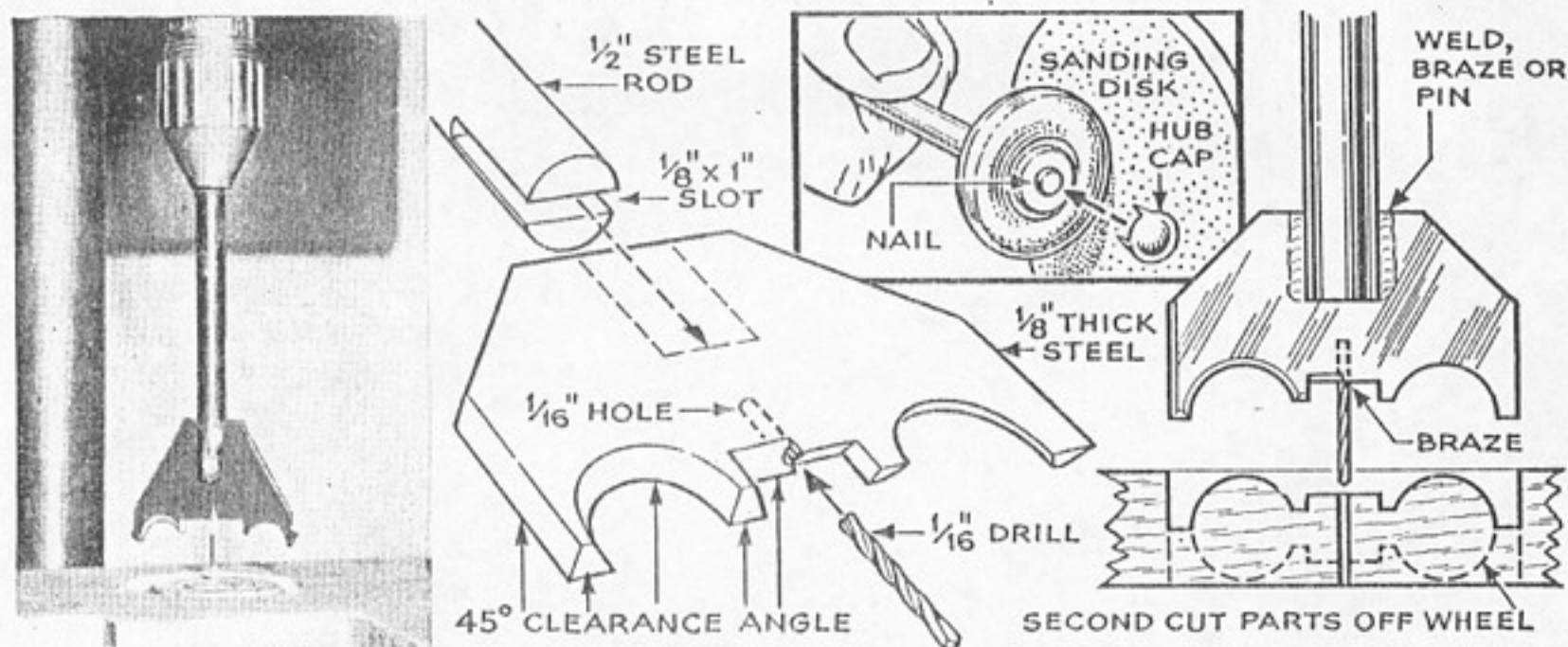
It is not necessary to add plaster to the bottom of the jar, as its own base makes a solid foundation for the finished vase. You may want to build up a plaster rim above the neck of the jar,

however, to conceal the lowly origin of your splendid vase. Note how this is done in the accompanying illustrations. After the rough form of the vase is completed to your satisfaction, let it set for 45 minutes, and you'll be ready for the finishing touches. Carve off with your knife the little lumps and bumps that remain. If you prefer a rough texture, you may want to leave the vase in its original state, or finish it with a texturing tool. Unless you're willing to wait for several days for the plaster to dry completely, you'll have to forego sandpapering at this stage.

It is not possible to paint wet plaster, but you can color it easily at once by first giving it a coat of orange shellac. After shellac is dry, which will take about $\frac{1}{2}$ hour, go ahead and paint the vase. Lacquer best simulates a glaze finish, but tempera or even house paint makes an acceptable job. It is possible to use cold water or casein paint, if you wish, although to insure permanence you'll have to cover either one of these with another coat of shellac. As soon as your final finish is on, the vase is ready for use. A cup or two of water, a bouquet of flowers, and you have another attractive home decoration.

POPULAR SCIENCE

SEPTEMBER 1948



Revolving Blade Cuts Wheels for Small Toys

CHUCKED in a drill press, this revolving cutter solves the problem of making wheels for toys or models. Materials required are a piece of $\frac{1}{2}$ " steel rod, $\frac{1}{8}$ " steel plate 3" square, and a $\frac{1}{16}$ " twist drill.

File one edge of the plate to the desired profile of the wheel. The diameter of the wheel will depend of course on the distance between the outer edges of the two semi-circular cuts in the plate. For clockwise rotation, file the left cutter to 45 deg. on the front edge, the right side to the same angle

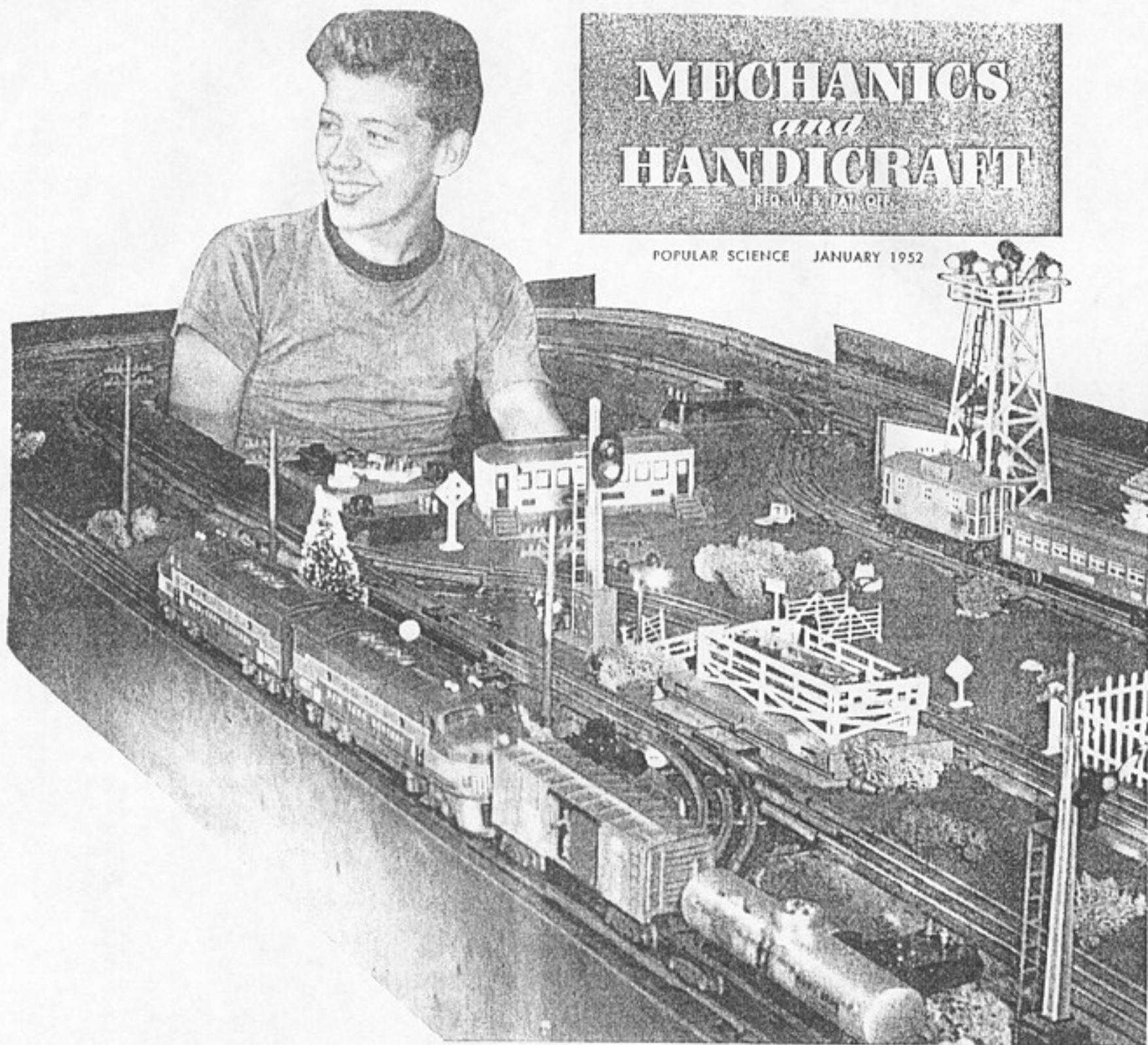
on the reverse, keeping them symmetrical.

The drill acts as a center pin. Braze or solder it in place. Hacksaw a $\frac{1}{8}$ " by 1" slot in the steel rod and weld, braze, or pin it to the blade. Operate the cutter at moderate speed. When you've cut halfway through, turn over the stock and complete the cut from the other side.

The wheels may be smoothed off by allowing them to rotate against a sanding disk. A furniture glider pressed in place makes a good hub cap.—W. H. Greenfield, Reno, Nev.



POPULAR SCIENCE JANUARY 1952



Electric Trains Are Fun All Year

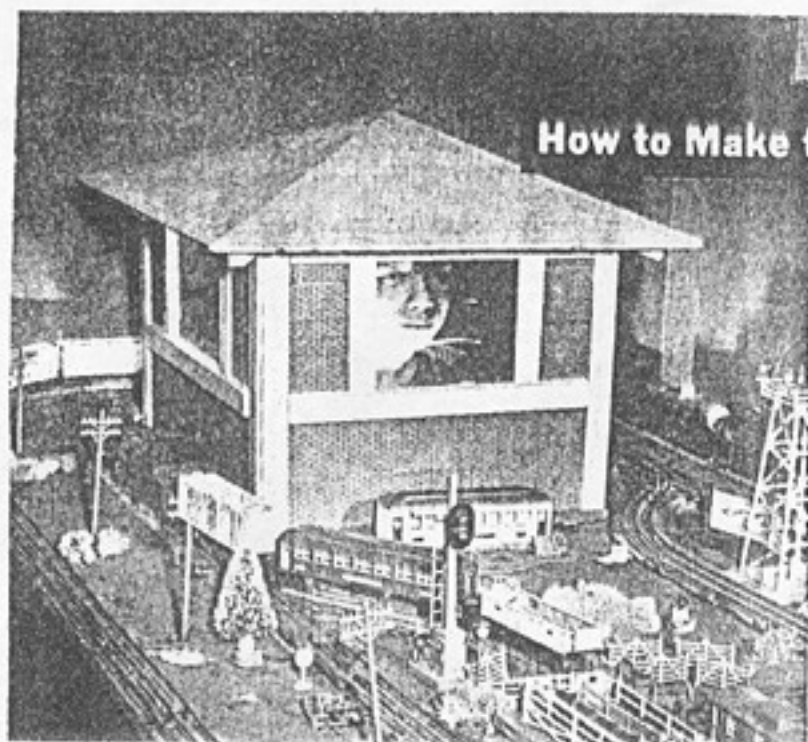
**Don't pack them away with the Christmas decorations. Give them
a permanent place—and they'll give you a permanent hobby.**

By Henry Abraham

MANY a new electric train highballs under the tree on Christmas morning. For a couple of weeks it runs on a rush schedule, with Dad pulling the throttle as often as Junior. But about January third, Dad gets back to the newspapers and Junior finds the sledding is wonderful.

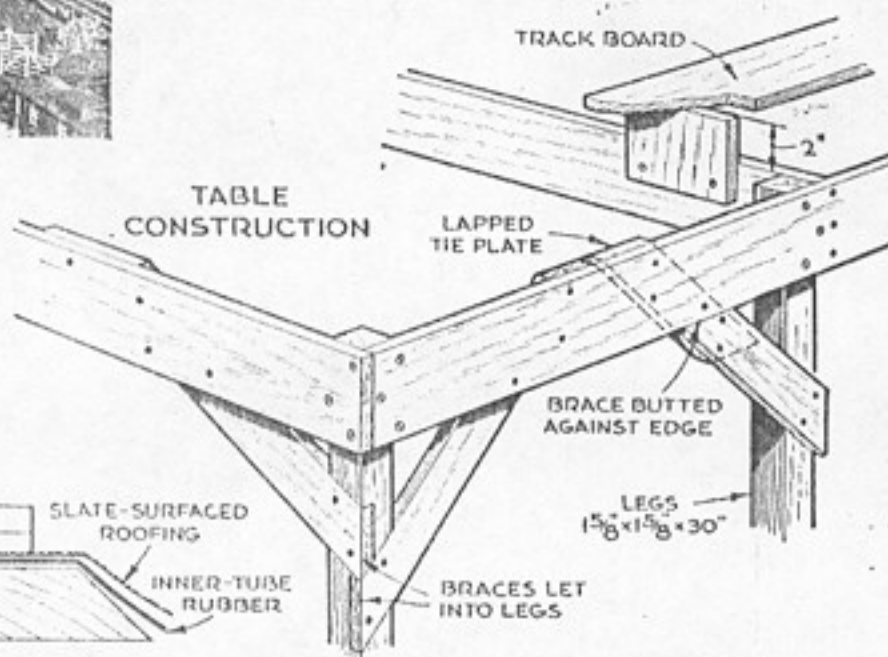
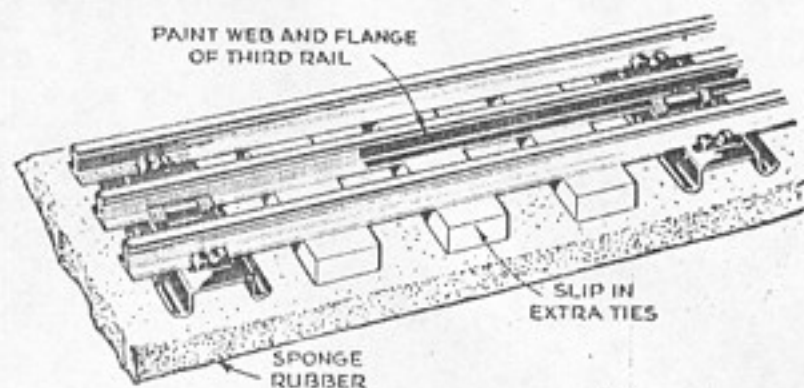
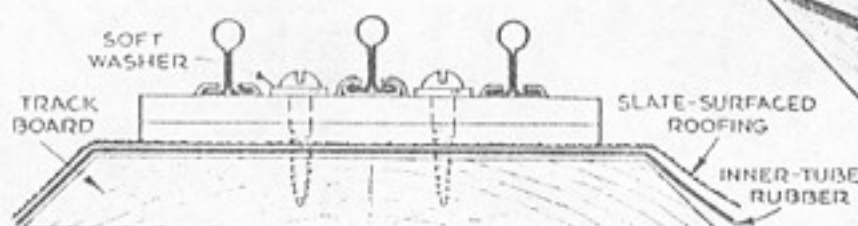
That's when Mom pulls the track apart and retires the rolling stock to a closet roundhouse. If Dad and Junior notice, it is with relief at escaping the cleanup chore.

How come? Why does a train lose its appeal? Nine times out of 10, it is because the layout is on the floor. That's like putting glue on a fielder's mitt. You just can't play



How to Make the Most of Tinplate

CONTROL PIT inside table gives a full view of train movements on this slick O-gauge layout. The switch tower in which the operator sits has only two walls and can be lifted off easily.



that way. Dad gets cricks in his back, Mom can't clean, track and rolling stock are stepped on, and Junior realizes that broadloom doesn't look much like scenery.

Keep it rolling. Model railroading is too much fun to let this happen. But if the model pike is to be ready for the kids on a rainy afternoon—and, for Dad to play Casey Jones after supper—the layout must be set up so that it can be used any time. That entails mounting it permanently off the floor, so that the tedious chores of setting it up and packing it away are unnecessary.

My own real interest in the hobby, for example, began only when the trains were mounted on tables. In the 12 years since, my enthusiasm has grown along with my layout, which now nearly fills a big cellar.

Where to put it? A good site for your permanent layout is the attic, cellar, garage or spare room. But if you don't have any of these to pick from, you can hinge the track panel to a wall along one edge and hinge drop legs to the outer edge. This gives you a railroad that folds out of the

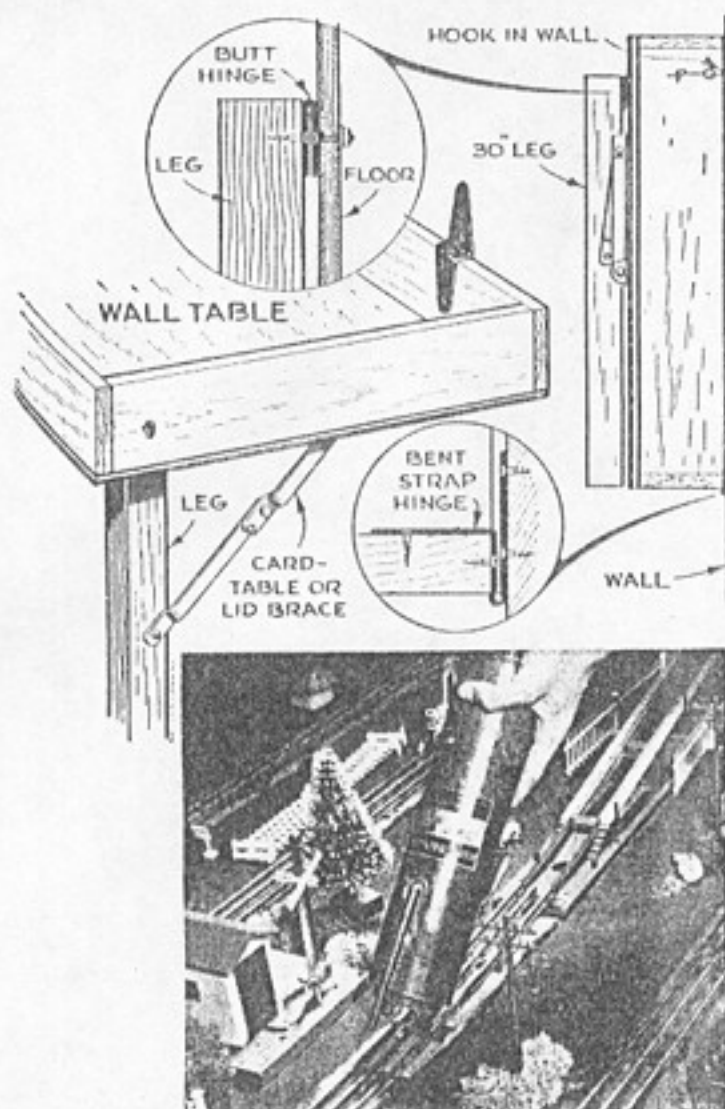
way when not needed. Another dodge is to put casters on the panel so that it can be rolled under a bed.

If you have a choice, the cellar is usually the best location. In an attic, low headroom may make much of the floor unusable, and winter cold and summer heat are extreme, whereas a cellar is moderately comfortable at most times. A garage layout may be all right in Florida, but I'd rather not have one in Maine or Wyoming.

A spare room is fine if it's really spare. You don't want to pull spikes every time cousin Agnes comes visiting.

Tinplate or scale? Once you've decided where to put your permanent railway, plan the layout. This depends a good deal on the equipment you have. *Tinplate* models, the kind that start many a model railroader off, get the name from their tinplate tracks. The curves are sharper than scale curves, and they don't look much like real rails. But you can push the sections together, clip on the power leads and have a train running in five minutes.

Scale track is a miniature version of the



RAYON FLOCK, blown from handgun, becomes grass, sand or ballast.

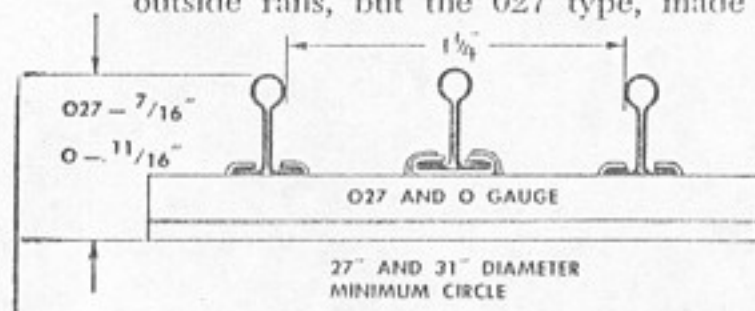
real thing. Rails are solid brass, aluminum or steel, spiked to wood or fiber ties. You can spike your own rails or buy them ready-mounted.

Maybe, like me, you'll start with tinplate and go on to scale later. Let's assume you have tinplate now, and see how you can make the most of it.

Any layout worth the name will even-

How Tinplate Gauges Compare

The 2½"-gauge trains Dad played with are museum stuff now. Today's standard tinplate is O gauge. It is all 1¼" between outside rails, but the O27 type, made for



tually need room for turnouts and parallel tracks, so your space should be at least 4' by 8'. I recommend making a drawing of your railroad-to-be on paper ruled into squares, each representing one square foot. Be sure to allow room for trackage and features you will want to add later—including those you haven't thought of yet!

Don't be a flatlander. If you want a realistic layout—and I think that a lot of the fun lies in making it look like the real thing—don't put your tracks on a flat, overgrown table. Only a scenic artist can make a flat plywood panel look like anything else. Instead, build a supporting framework 30" high and on it put just enough flat stock to form your roadbed. Better still, mount the track boards on supports 2" above the table framework.

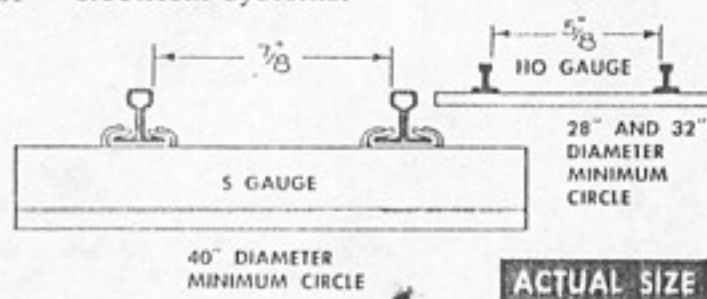
This construction permits a greater variety of scenery. Hills, valleys, rivers, cuts and fills are easier to create. The open spaces between tracks are filled at different levels with plywood, scrap lumber and wire screening. Plaster applied over this transforms it into realistic terrain.

And while you're building the supports, don't forget that noise will be a problem. Put a sound-absorbing layer of thick felt, ¾" sponge rubber, cork board, roofing paper, or inner-tube rubber under the tracks. Even the screws that hold down the tracks conduct noise. Sound-insulate these with a bit of cardboard under each screwhead.

Don't omit any of the track-connecting pins. If any are loose, see if the rail has opened. If squeezing it back into shape doesn't remedy matters, bend the pins slightly to make them a tight push fit. The inside of all rail joints should be flush, or you can expect derailments and noisy run-

compact layouts, turns sharper curves and is lower than regular O. The two cannot readily be mixed.

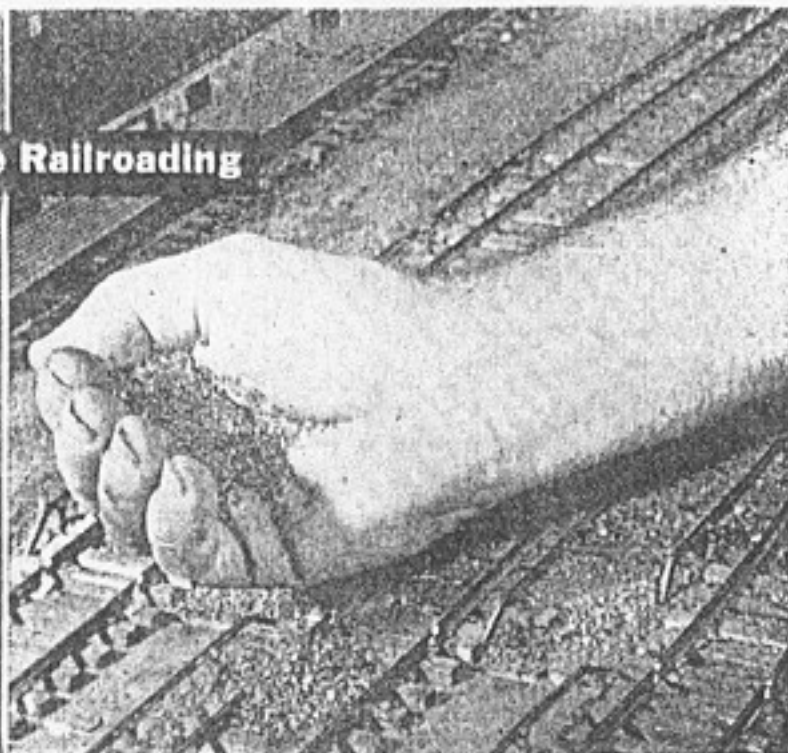
S-gauge tinplate and HO-gauge tinplate both have square rails and two-rail electrical systems.





This Is Scale Railroading

YOU'RE NEVER DONE, once hobby has a good hold. Here author lays new track to turntable (at rear). Solid rails are spiked to wooden ties. Ability to solder is a must.



TRACK BALLAST is bird gravel, dyed gray. Outside third rail makes for simpler wiring than a two-rail system, and closely resembles full-size electrified construction.

ning as the wheel flanges pass the joints.

Make it look real. Gray sponge rubber, beveled at the edges, looks like a ballasted roadbed. So does slate-surfaced roofing paper. Or you can paint the roadbed with glue and sprinkle on bird gravel.

Sand, dirt and grass surfaces are nicely imitated with flock—tiny rayon fibers you blow on over an adhesive coating. It comes in all colors.

Extra ties, cut from wood and stained or painted dark brown or black, improve the appearance of tinsplate track. One manufacturer makes flexible O-gauge tinsplate track in 3' lengths mounted on closely spaced wood ties. It can be curved and will mate with regular tinsplate track and switches. The center third rail on O-gauge tinsplate can be made less conspicuous by painting its flange and sides—but not the top, of course—the same color as the roadbed.

How many rails? For complete realism, many hobbyists prefer a two-rail system. In this, the running rails are insulated from each other. Both serve as conductors. Current flows into the wheels on one side, through the motor and out through the wheels on the other side.

Converting O-gauge tinsplate to two-rail, however, is costly and complicated. It's probably wiser to start with what you have, and use ingenuity to make the most of it.

Don't stop with tracks and scenery. Houses and railway structures can be bought in kit form at hobby shops—also scale trees, shrubs, fences and farm animals.

Next step: DC. Once you get going, you may want to convert to direct-current operation. This will give you instant, positive reversing instead of the seesaw operation common to alternating-current reversing. You will know before turning on power which way the engine is going to run and so will be able to move the trains realistically.

For direct current, you must add a rectifier to your transformer. Ask your hobby dealer for one that will handle the maximum voltage and output (in watts) of your transformer. You can use the old speed control on the transformer, but will need an extra double-pole, double-throw switch. This controls train direction by reversing the polarity of the track.

You will also need a small rectifier for each locomotive. It must be connected across the field winding of the motor so as to keep current flowing the same way in the field even when you reverse it in the armature. Then the motor runs the other way. Let an experienced model fan help you with this unless you know your engine and can get instructions for wiring the rectifier.

No track changes are necessary, and you'll find that on DC your engines start in a slower, more realistic way and can pull heavier loads.

Rolling stock. You can add greater realism to your tinsplate layout by getting scale freight cars and putting on tinsplate trucks. Kits can be bought with either kind of trucks. They come in a larger variety of



IT'S A SMALL WORLD, but this corner of Henry Abraham's scale layout shows how real it can look. Trap doors like one he's standing in give access to any part of system. His loco-

motives run on direct current. Transformers and rectifiers that supply power are housed in a ventilated case just under switch-studded control panel shown below.

car types than the non-scale ready-mades, and, because you put them together yourself, are cheaper. Don't, however, buy scale engines or passenger cars for tinplate track, as these are too long for the short-radius curves and their small wheel flanges will not hold the rails.

If you ever want to convert to two-rail scale track, you can adapt both the scale stock and your original tinplate cars by simply substituting scale trucks. To convert your engine, though, you'll have to turn down the wheel flanges. Unless you have a lathe and experience, better leave this job to your hobby dealer.

Pointers that pay. Twelve years of this hobby have taught me some things the hard way:

- Don't use bell wire for connections. The covering unwinds, causing shorts. Use No. 16 or 18 rubber-covered stranded wire.
- Solder connections whenever possible, especially those to clip-on (Falmestock) terminals. Then you won't have to track down open circuits.
- Solder track joints, too, once you are sure the layout is permanent. This will insure good electrical continuity.
- Build your control board on a plywood panel separate from the layout. Then it can easily be altered when you make changes—as you undoubtedly will.

These are just suggestions. One of the pleasures of model railroading is that your system develops just the way you want it to. You're the boss—so go to it! END



About the Author

HENRY ABRAHAM, an insurance agent, didn't dream what he was starting when he moved the kids' trains into the cellar. In 12 years, the layout, converted to scale, grew to 30' by 45'.

Being civic minded, Abraham makes his hobby serve the community. Boys from the neighborhood Police Athletic League and Boy Scouts are weekly visitors. Since 1942 he has put on a yearly show that packs in adults as well as youngsters. Receipts from a 10-cent admission go to the Red Cross. In 1951 they totaled \$350.

The payment Abraham received for this article went to make a long-cherished dream come true. He traveled 3,600 miles—by train—to visit a model pike even bigger than his.



July 4th Fun

Can Be Safe

REMEMBER when the Fourth was a day of cannon crackers, skyrockets, pin-wheels and roman candles? Fun, weren't they? But what marred those good old days was the salute that went off in a child's hand, the fizzler that let go when somebody looked at the fuse, the roman candle that backfired, the skyrocket that landed on a shingle roof.

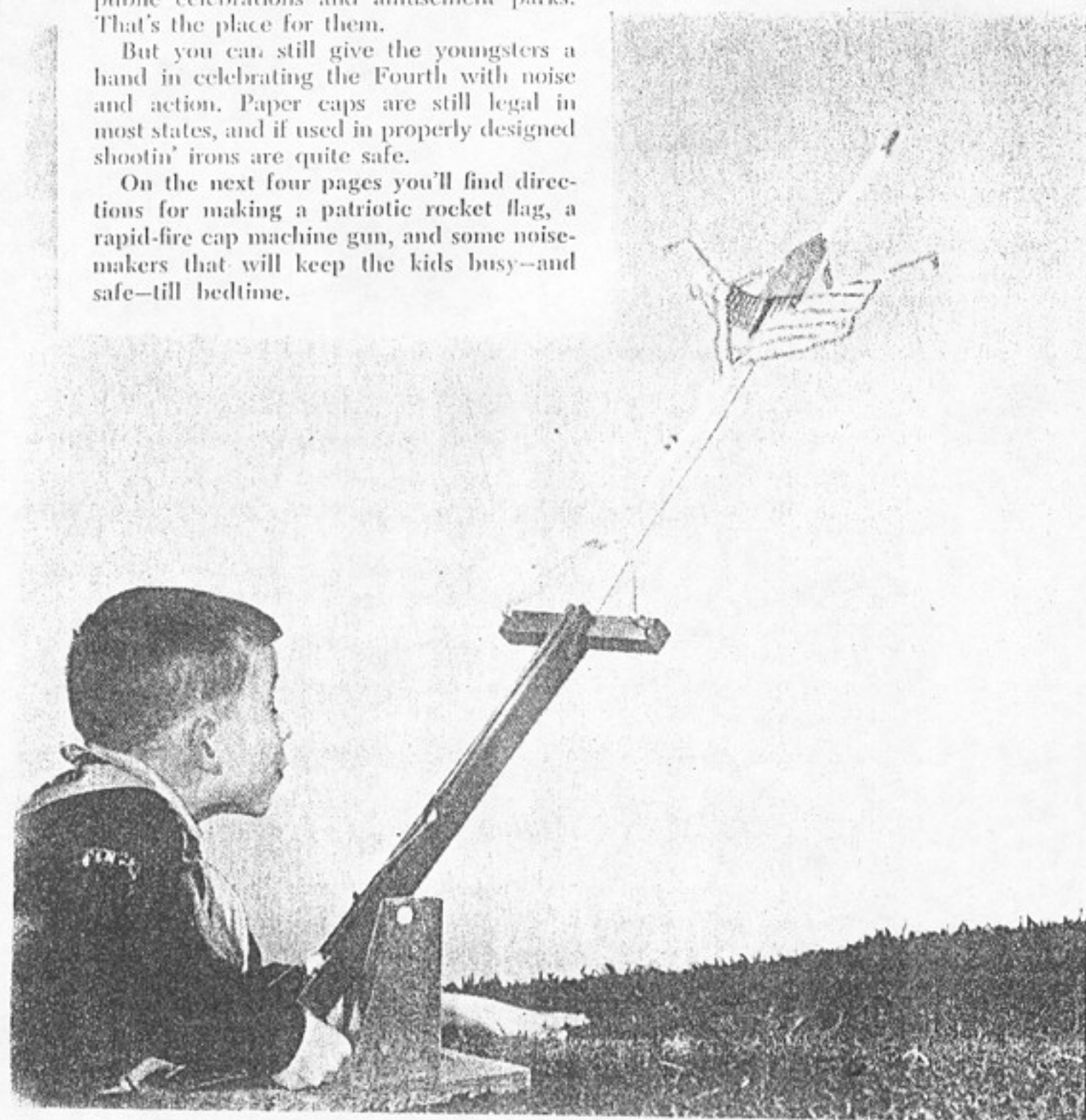
Today, 27 states and many cities limit the use of fireworks. Deaths and injuries from July Fourth mishaps are down. You can see beautiful fireworks displays at public celebrations and amusement parks. That's the place for them.

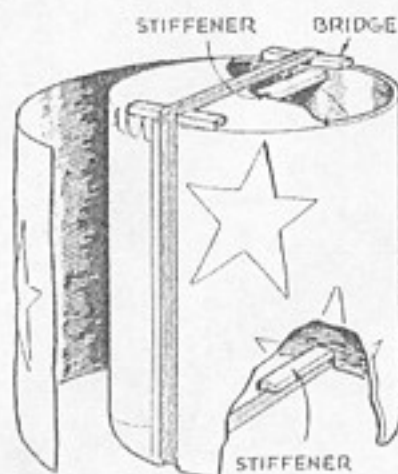
But you can still give the youngsters a hand in celebrating the Fourth with noise and action. Paper caps are still legal in most states, and if used in properly designed shootin' irons are quite safe.

On the next four pages you'll find directions for making a patriotic rocket flag, a rapid-fire cap machine gun, and some noise-makers that will keep the kids busy—and safe—till bedtime.

Here are seven quickly made toys that will give youngsters a happy celebration this year.

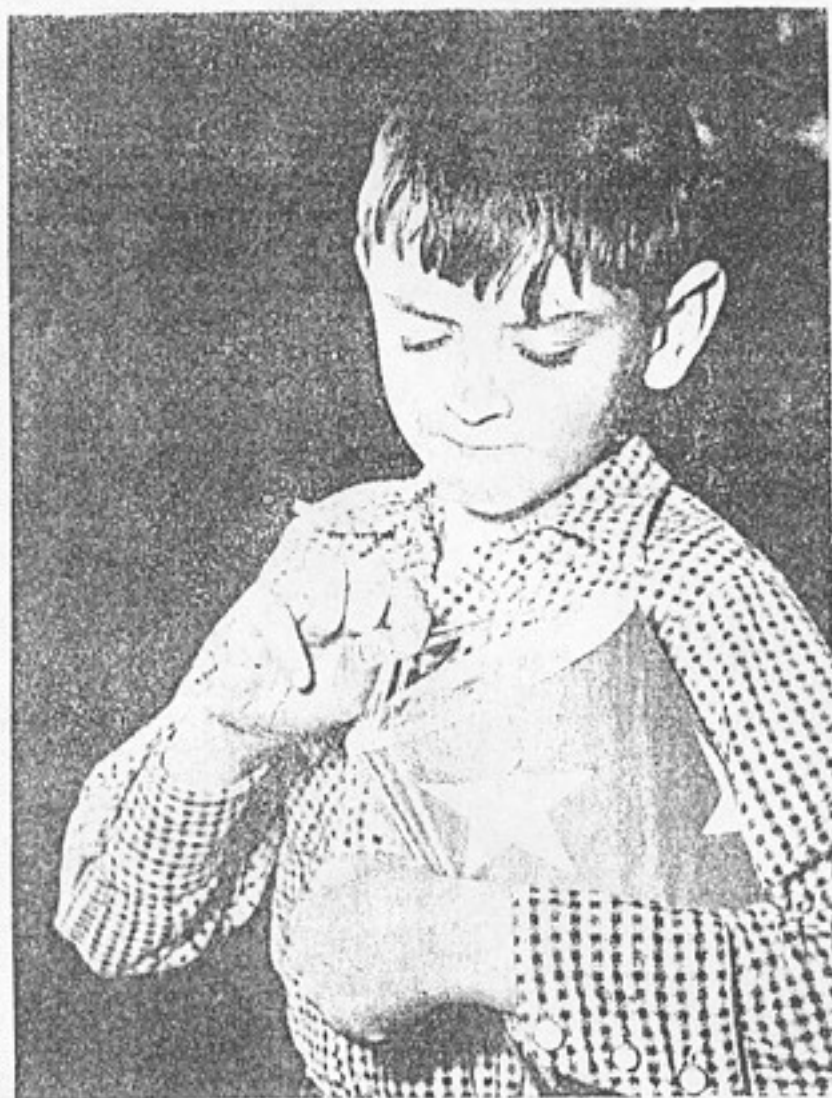
POPULAR SCIENCE JULY 1954





BOX O' CRACKERS

The brittle chatter of "lady crackers" is punctuated in this noisemaker with a cannon-cracker bang. Cut an 8" length of 5" or 6" shipping tube and cement on a head of tough manila paper. Glue in wooden stiffeners at bottom and top. Moisten paper head so it will tighten on drying. Stretch half a dozen thin rubber bands around tube, and one heavy one. Pluck thin bands for the rattle of crackers, the big one for the bang.



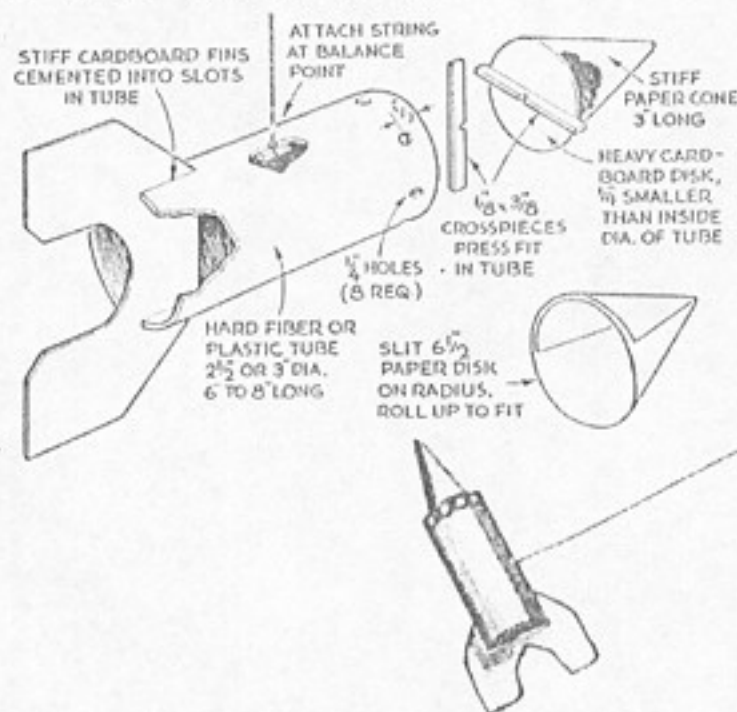
RAMJET WHISTLE

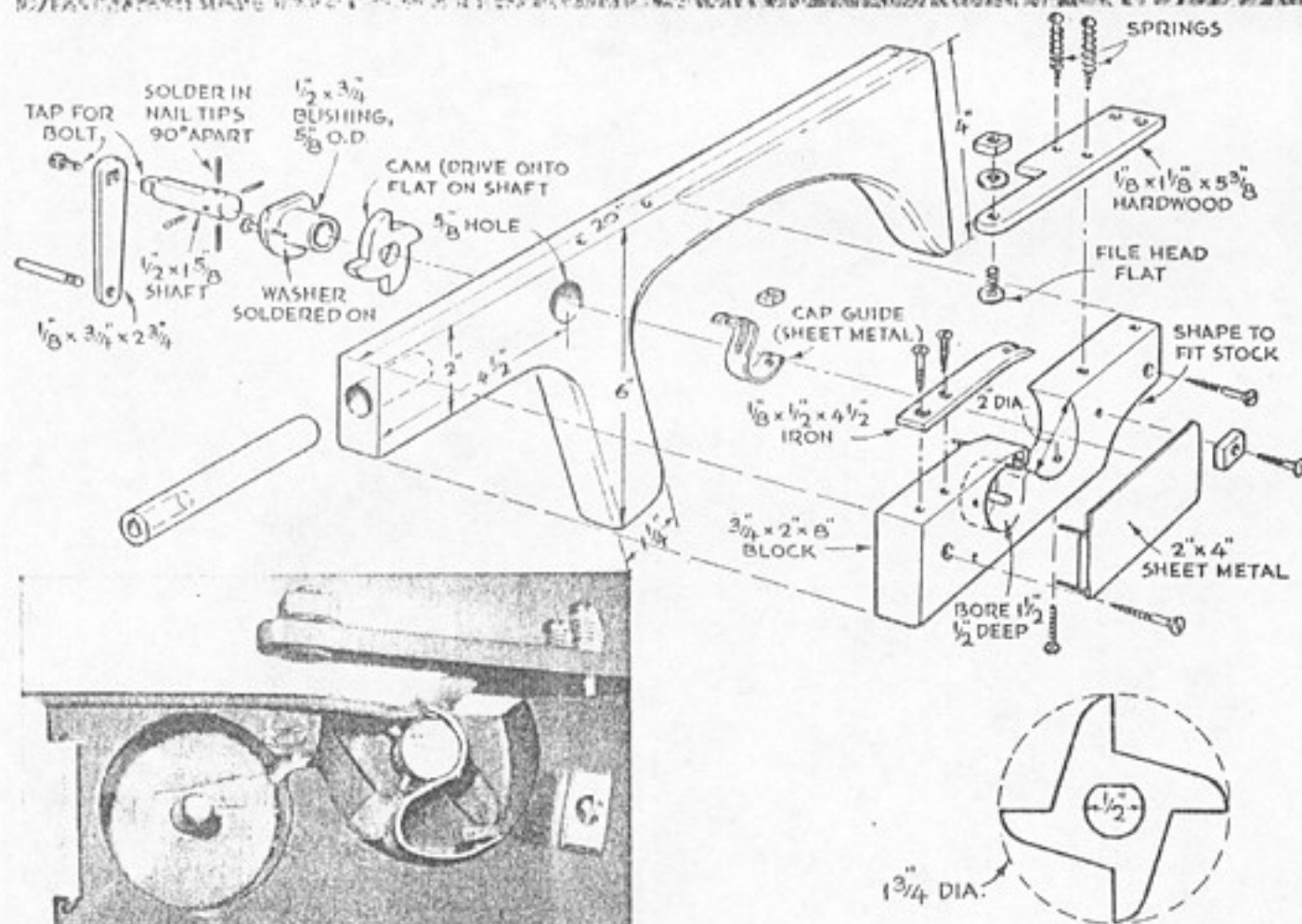
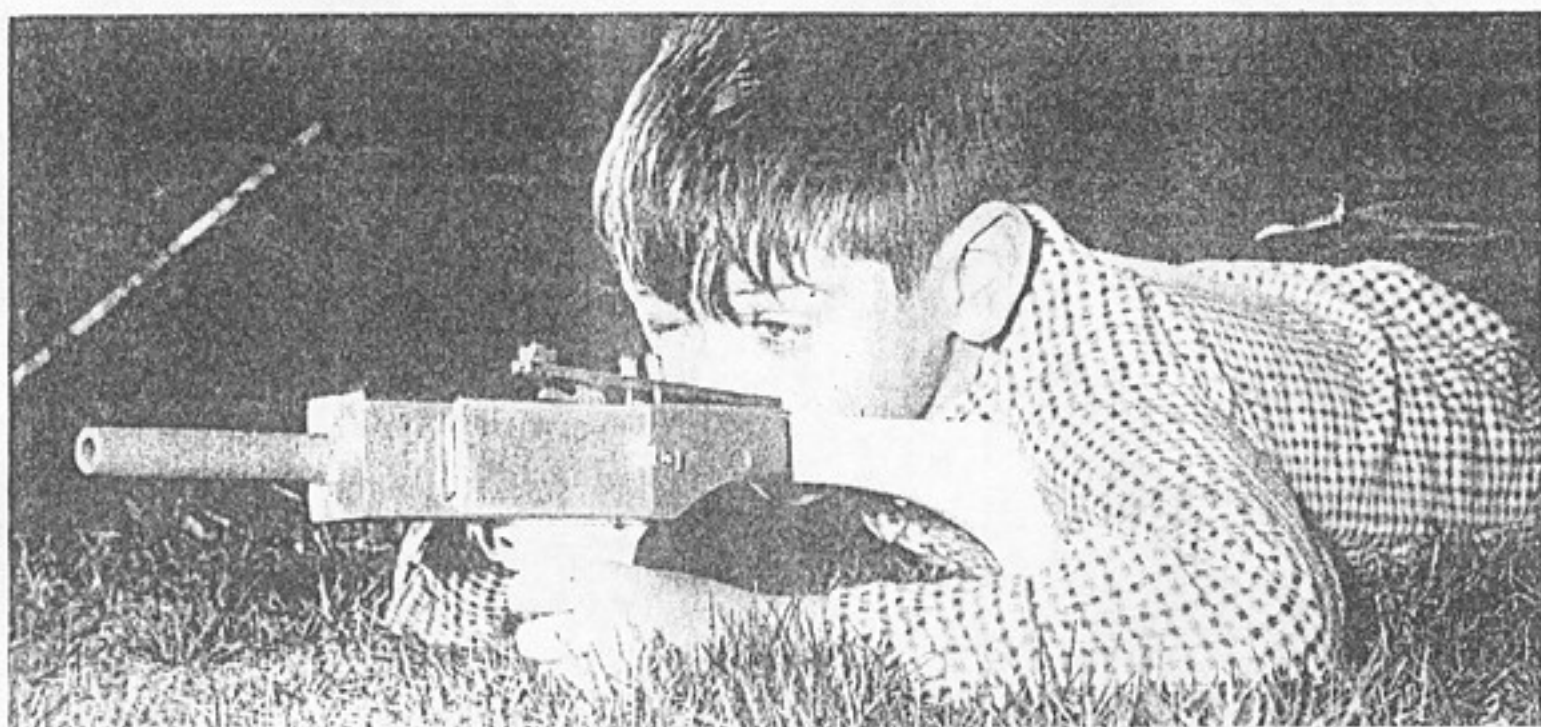
Whirl this whistle around at the end of a 5' string and it will howl like a banshee. A fiber or plastic tube is best for the body, although a stout mailing tube might do.

Roll the cone from a disk of heavy paper, overlapped to the proper diameter. Make it $\frac{1}{8}$ " smaller than the tube, and cement it

to a cardboard disk of the same diameter. Cross-lap two sticks as shown, letting them project to form a tight fit in the end of the tube. Slide the tail into slots cut in the opposite end of the tube.

The location of the cone is critical if you want a good whistle, and some experimentation may be needed to produce just the sound you want.





CAP-FIRING MACHINE GUN

This fast-shooting piece uses rolls of *perforated caps*. The holes, spaced one cap apart, run over pins in the camshaft and so are positively advanced. Make sure of your cap supply first, for not all dealers stock them.

Saw the frame to shape and drill a $\frac{3}{8}$ " hole for the bushing in which the camshaft turns. Solder a large washer to the bushing so that it can be screwed to the right-hand

side of the gun. Shape the breechblock and glue and screw it in place. The camshaft is filed from $\frac{1}{2}$ " rod or a $\frac{1}{2}$ " bolt. File a flat for the cam hole, file the cam to a tight fit, and drive it on. Drill crosswise holes through the shaft and solder in four nail ends projecting $\frac{3}{32}$ ".

The cam lifts a hammer made of $\frac{1}{8}$ " hardwood and loaded by two springs. It is attached by two screws left loose. A bolt at the end strikes a steel firing plate.

THE RAUCOUS CAN

It's simple, but this can makes a nerve-shattering racket, surely enough to satisfy any youngster.

Cut the top out of a No. 2 tin can. Punch a small hole in the center of the bottom. Tie a knot at the end of a 4' length of string and pull the other end through the hole. Rub rosin all along the string.

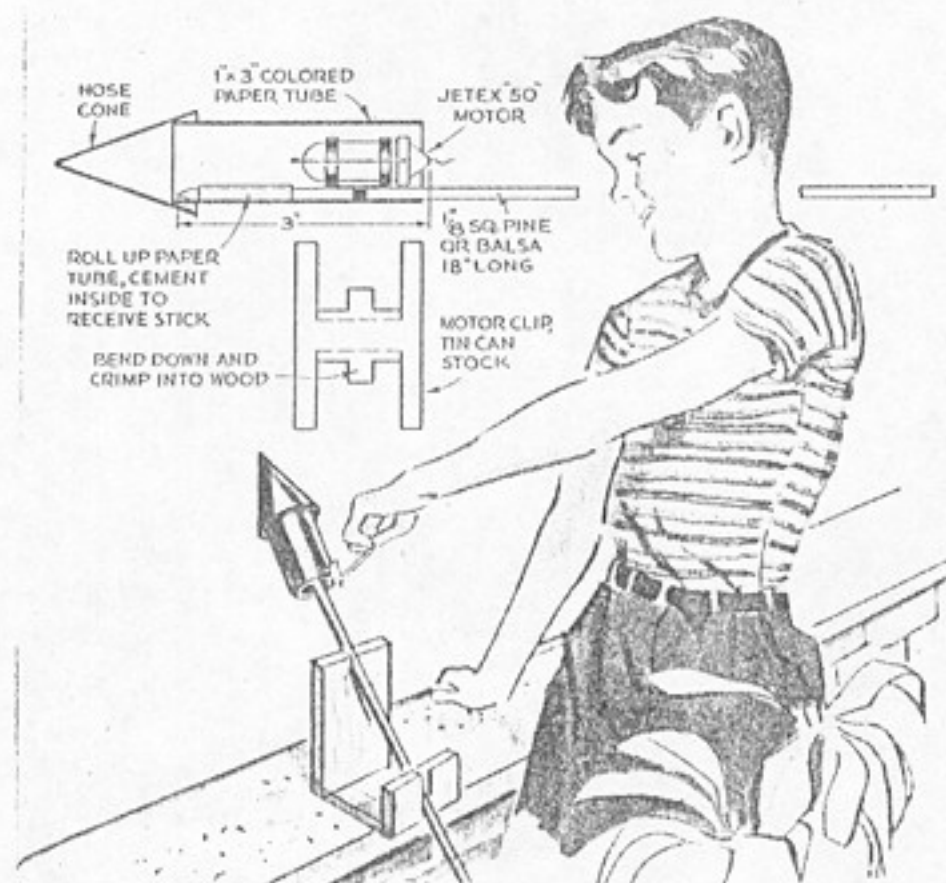
Once the string is well coated, simply pulling the fingers along the string brings forth the decibels. The day's efforts may prove rough on young fingers, which can be protected by pads of adhesive tape.

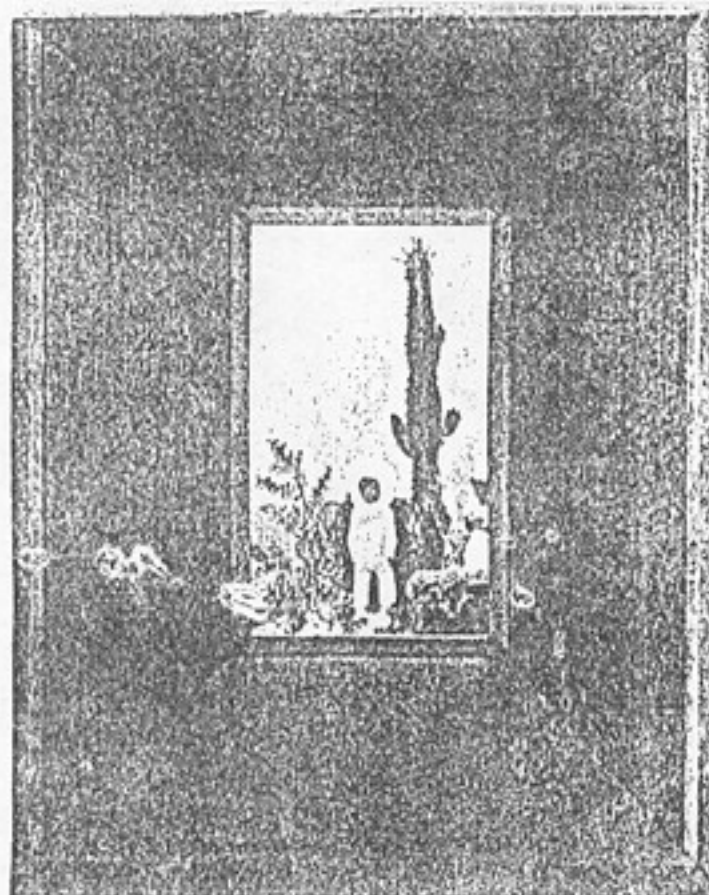
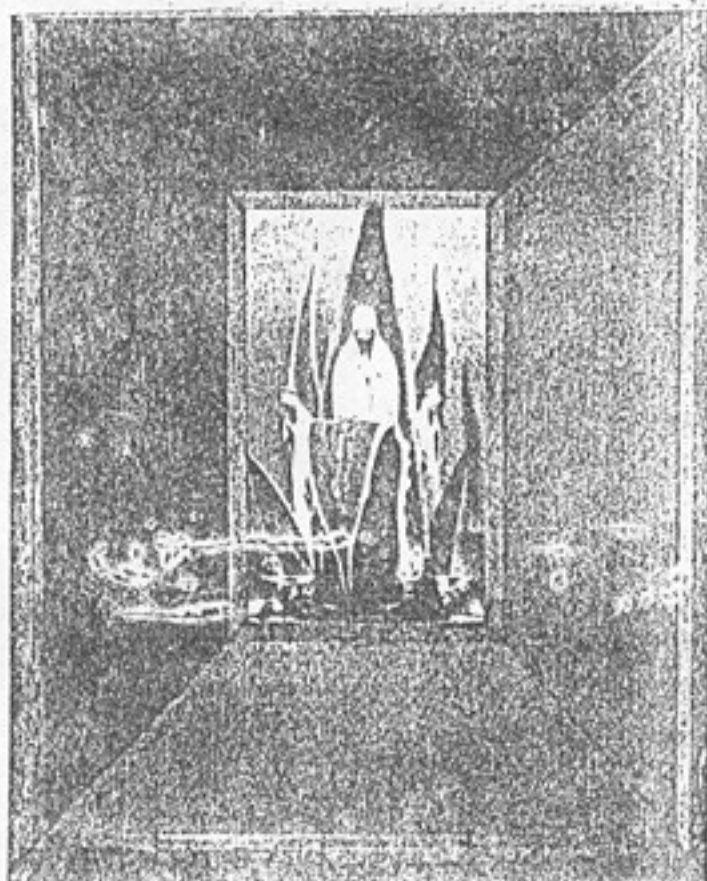
DAYLIGHT SKYROCKET

This real fireworks piece will be safe in the hands of any youngster who can be trusted with matches, and who can handle the cartridge and fuse needed.

It makes use of a harmless model-airplane jet motor, which can be refueled and shot again and again. Since it trails no sparks, the rocket affords no fire hazard, but it should be made in bright colors and fired in daylight. Keep the weight down and trim the stick so that it balances on a line with the orifice of the jet engine.

END





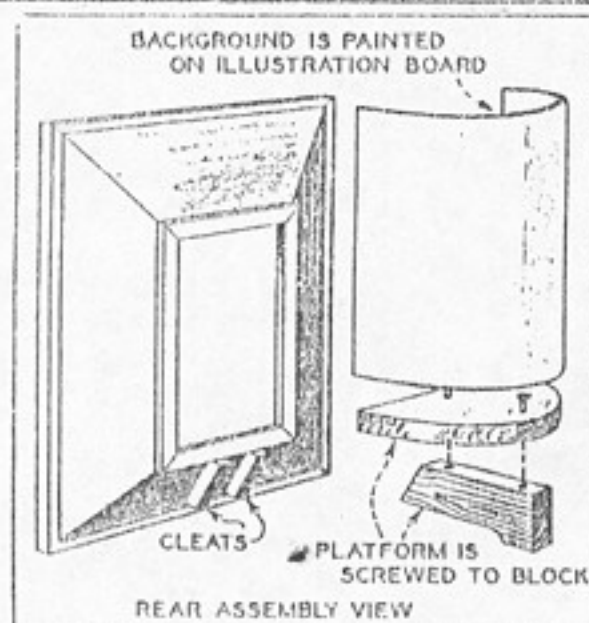
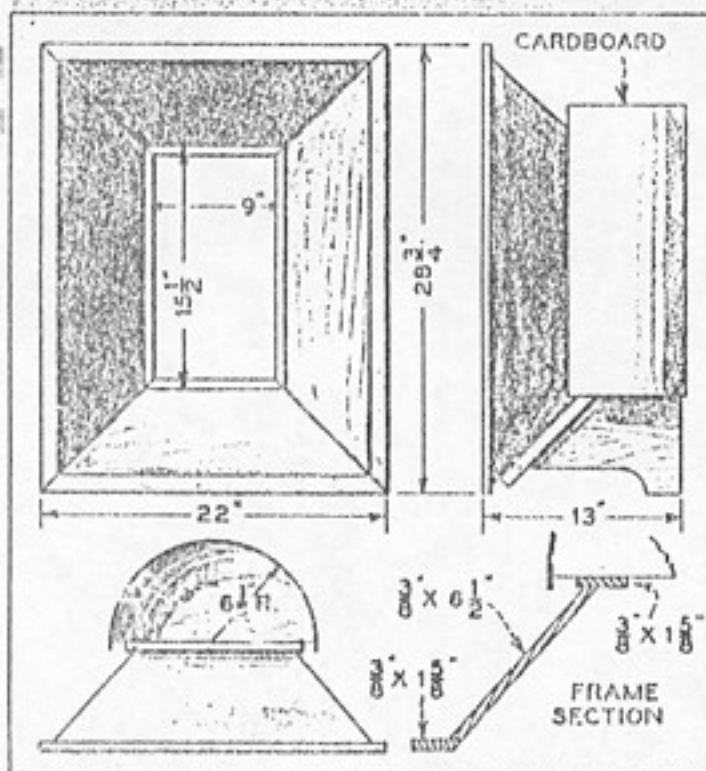
SHADOW BOX ART

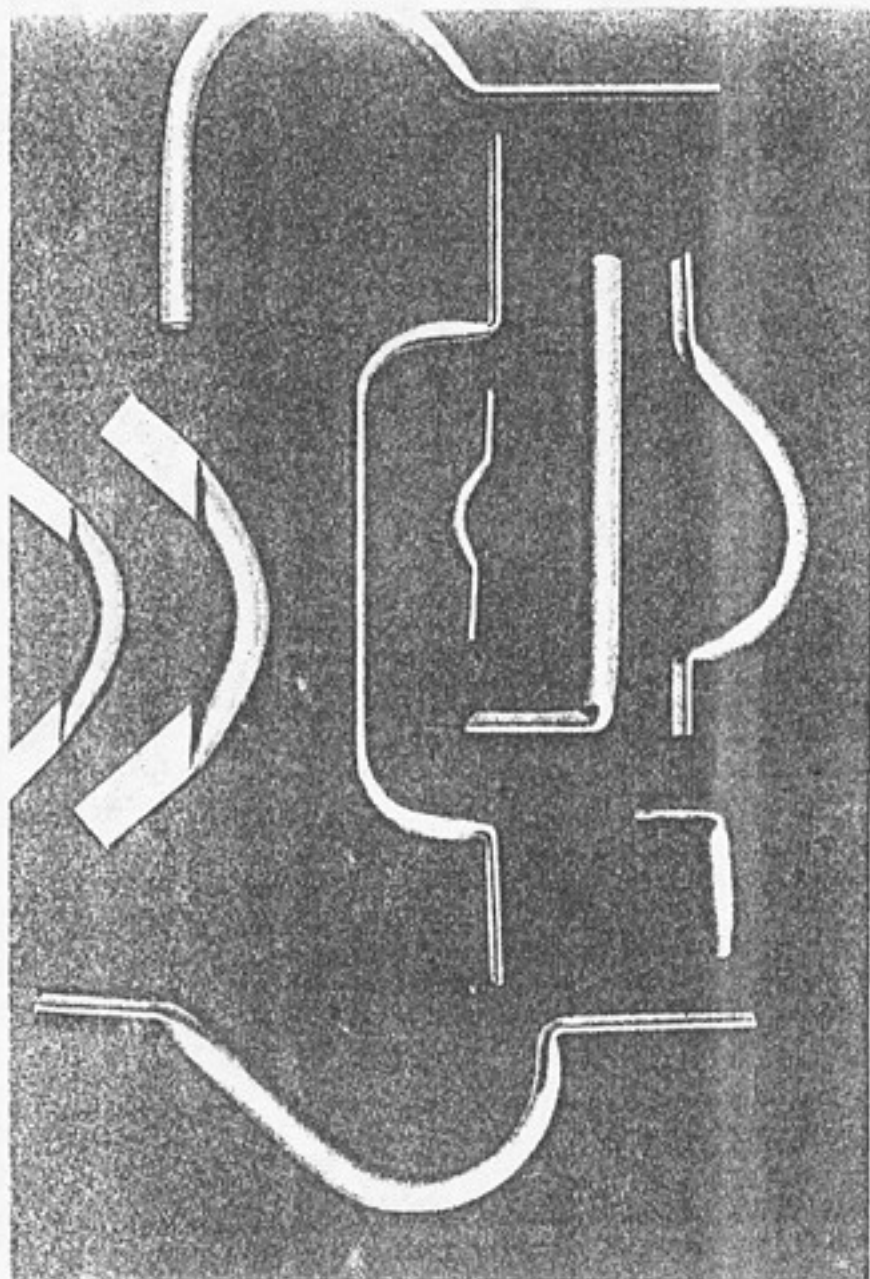
The popular shadow box offers many interesting possibilities. Try your skill with this model.

YOUR shadow box can reproduce scenes dear to memory with surprising fidelity; a vista in the Berkshires, a group down on the farm, that dude ranch in Arizona, or a view along the placid river. For general subjects, any appealing little figure will serve as a nucleus if one can visualize an appropriate setting. Novelty shops are a rich field for research. These two samples represent the clever work of Southern California artists and may suggest an idea to the novice.

Of course the frame is important, the unusual depth lending prominence to the scene. Natural light is admitted at the top; for artificial lighting, install a bulb above the set in back of the frame.

Making this frame requires only the simplest kind of carpentry except for some painstaking work mitering the corners where the pieces join. Better leave this to the mill or an accommodating cabinet maker if you do not have proper equipment for the job. Small brads and casein glue are used in assembling. Backgrounds are painted on illustration board bent around and tacked to the platform.





The specimens, in the photograph above, represent some of the more common shapes you can make by following the instructions in this article.

Mechanix Illustrated November, 1947

BY R. J. DE CRISTOFORO

Bending

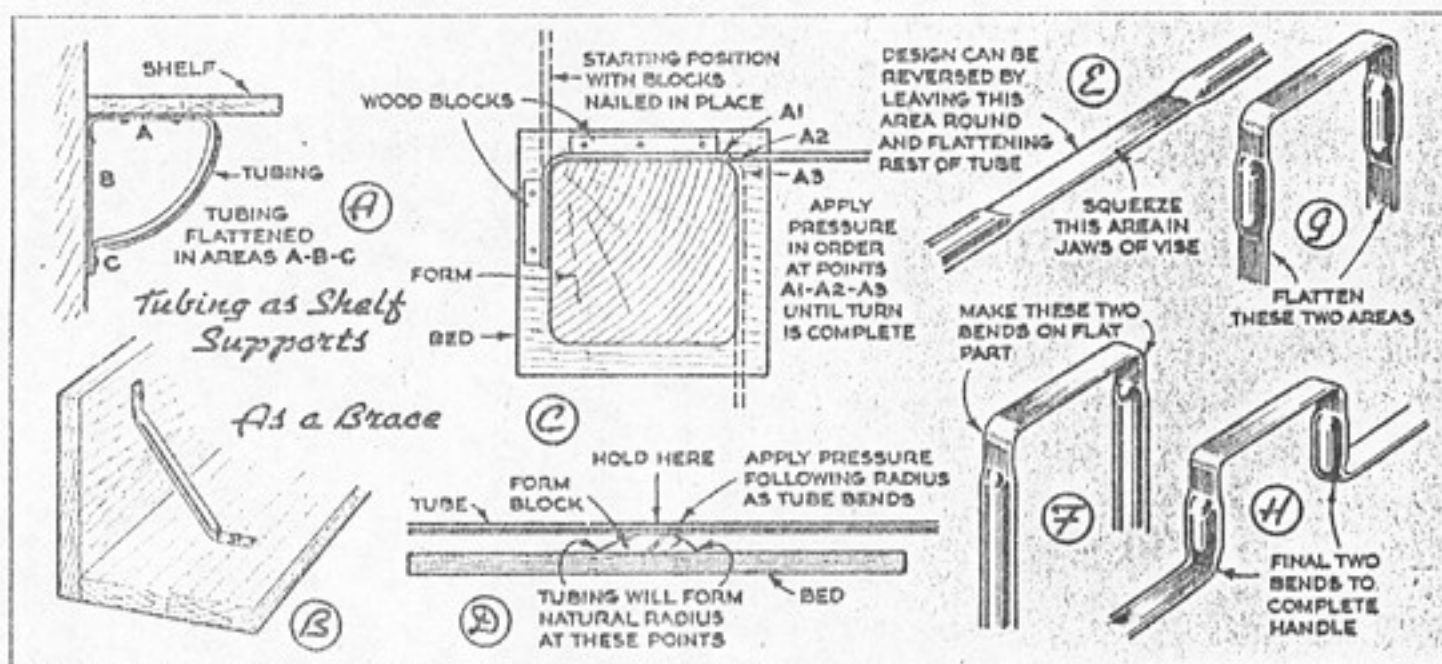
Bending intricate shapes out of tubing is easy—if you know how

THE possibilities and the many uses that tubing can be put to are unlimited and while this article is intended primarily to stir the imagination of the home craftsman and small shop owner, it will also give some examples and methods of machineless tube bending.

Small tubing may be bent without a filler especially where the tube walls are relatively heavy in comparison to the size of the bore. All the tubing in the photographs and in the examples is aluminum of the 24S-O variety. It is soft, easily worked, will polish to a high gleam and will take a sharp radius. While the harder types of tubing may be bent and formed by hand, they may crack in the vise. They should not be used, therefore, except in a form that will not require a flat area.

When a very sharp bend or radius is required, flatten the tube in that area and make the bend on the "flat" since a much sharper radius is obtainable in this manner than could be formed while the tube is in the "round."

The drawings E, F, G and H show the four steps needed to form a lift-type handle. Remember that the tubing is strongest when in its natural form. Always try to leave the tubing round at the point of greatest strain.



Tubes by Hand

Drawings A and B show how tubing can be used for a shelf support and as a brace. Christmas tree decorations can be made by flattening scrap pieces of tubing at both ends and drilling a hole at one end for a string.

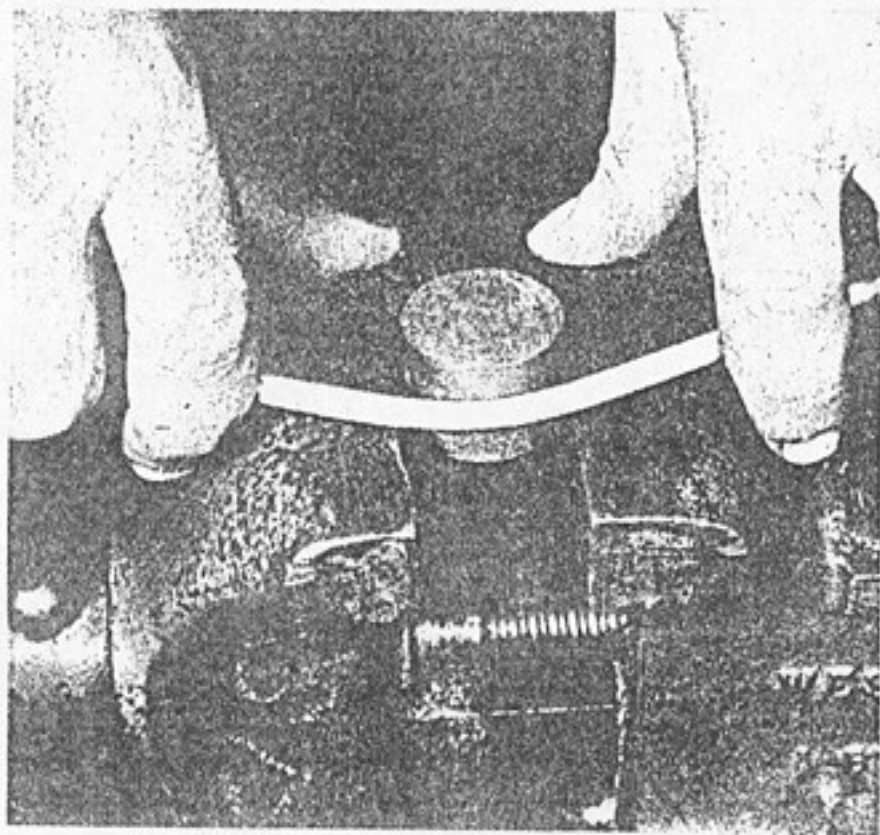
When it is necessary to conform the



shape to a close dimension, it is best to build a form or small jig. Drawing C shows an example of such a form. Sometimes it is necessary to form many pieces of a similar shape and type. In this case it is best to make a small jig. Drawing D shows how a particular loop or radius may be formed over a form block.

Finish off the handles or whatever projects you may choose to make from tubing, with a fine steel wool and a light oil. Dry off the oil and apply a coat of Simoniz. You will have a durable and gleaming finish.

Flattening the ends of a tube. Note that the point of the bend is not too close to the jaws of the vise so as to avoid marring the round area.

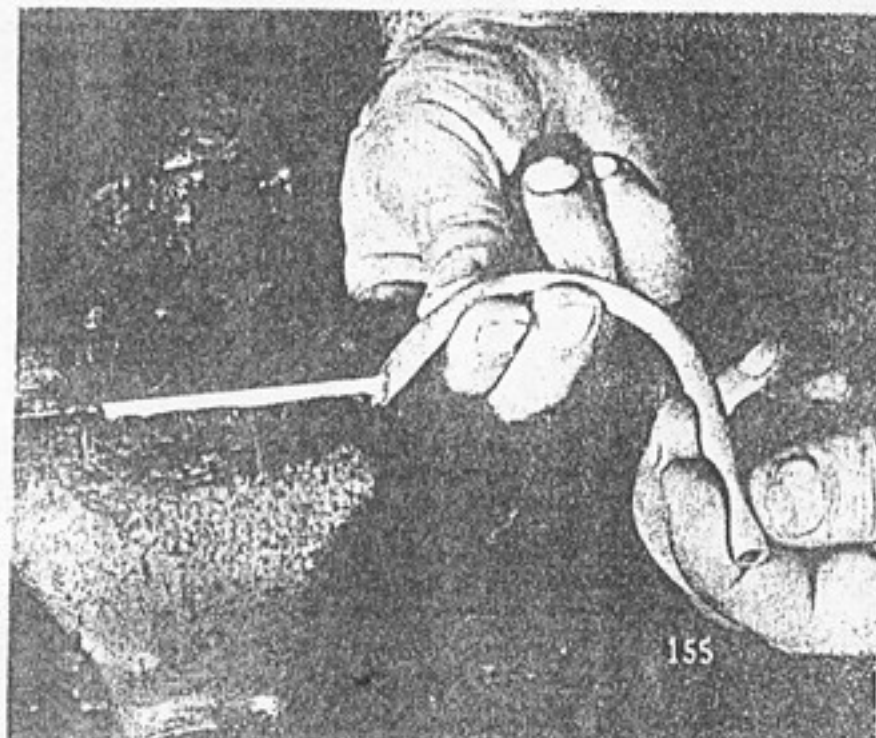


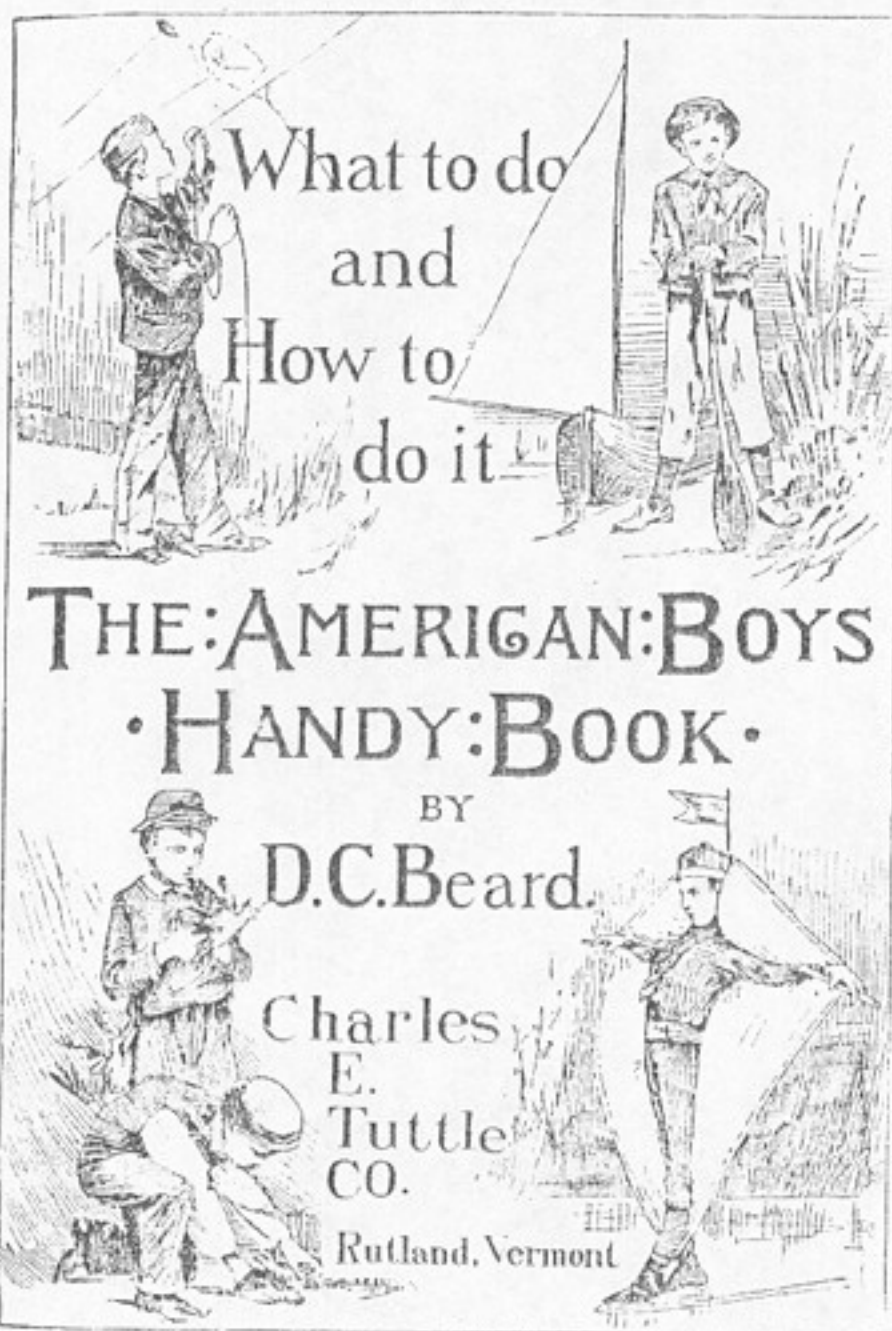
Making the first bend in a tube that will eventually become a drawer handle, similar to the two in the picture on preceding page.

After the bend has been formed, the ends of the tube are squeezed in a vise. Loop is slanted to the desired angle by pounding it.

Should there be a crease in the metal after a sharp radius has been formed, file it out with a small rat tail file and finish it off with fine emery. Then use the steel wool and oil.

You can make a simple and graceful pedestal out of a piece of copper or aluminum tubing by slitting the ends with a hacksaw and spreading and flattening them to resemble the letter H. Use a fine hacksaw blade. •





DANIEL CARTER BEARD. AN APPRECIATION

AT THE AGE of eighty-nine, Daniel Carter Beard finally sat down to write his autobiography. Over two-thirds of the resulting book—*Hardly a Man Is Now Alive*—is devoted to his boyhood—a somewhat disproportionate amount when one considers not only the age at which Beard wrote his life story but also the fact that here was a man who had pursued with great distinction such different careers as an artist-illustrator, writer, naturalist and a founder and early leader of the Boy Scouts of America. Beard obviously took delight in lingering so fondly on this period because as he wrote, "Grown people who have lost the power to recollect fully their own childhood and infancy are deprived of a great joy." Apart from this, however, he was wise to give us such a full account of his early days in Ohio and Kentucky, since his boyhood, indeed, was the source and inspiration of his life work in all the above fields.

Dan Beard was born in Cincinnati in 1850 but except for a short interlude there and in Painesville, Ohio, most of his boyhood was spent in Covington, Kentucky. His portrayal of life in a typ-

ical ante-bellum Ohio River town with its vivid recollections of the steamboats and the flatboats; his encounters with such picturesque characters as the "river rats," gamblers and pilots; the schoolboy pranks and outings on the Licking River, has not only the rich authenticity of a contemporary Midwestern genre painting by George Caleb Bingham but recalls inevitably the antics and experiences of Tom Sawyer and Huck Finn. In addition to the heady environment of life by the Ohio River, Beard's own family was, of course, a powerful influence in shaping his later life. His father, James Henry Beard (1812-93), was a professional itinerant portrait and genre painter whose specialized interest in animal painting was stimulated by his friend Audubon. Made a National Academician in 1872, the value of his work is now being recognized in the current rediscovery and appraisal of nineteenth-century American painting. Dan's uncle, William Holbrook Beard (1824-1900) also was a professional painter and National Academy member, who was best known for his humorous story-pictures of animals. With such a heritage, it is little wonder that Dan and his two brothers—James Carter and Thomas Francis ("Frank")—and sister Adelia all showed artistic talent. "Frank" early in life decided to become a cartoonist and ended up on the staff of the comic weekly *Judge*, but both James and Dan originally chose such mundane careers as the law and civil engineering respectively. In the end, however, their own artistic heritage and talent proved too compulsive for them to resist the temptation to go to New York in the 1880's and study art. From 1880 to 1884, Dan studied at the Art Students' League, where he became great friends with such compatible fellow students as Frederic Remington, Ernest Thompson Seton, and Charles Dana Gibson. Dan quickly found he could make a living while he studied—"I drew everything, I made designs for decorated delivery cards, labels for boxes, valentines, architectural drawings, Currier and Ives pictures and other paraphernalia which never should have been made or published."

His works soon attracted the eye of one of the Harper brothers who commissioned him to do designs for book covers and jackets. Soon he found his work in demand—for newspaper and magazine illustrations and cartoons in such periodicals as *Scribner's Monthly*, the old *Life*, and *Harper's Weekly*. Nice things began to be said of Daniel Beard the illustrator—one critic called him "the Gustave Dore of newspaper work," while *Public Opinion* dubbed him "the Mark Twain of art." Dan's illustrations for a Chinese story in *Cosmopolitan* caught the attention of Twain, and he asked him in 1888 to do the illustrations for his new book, *A Connecticut Yankee at King Arthur's Court*. The book, a biting satire of contemporary social mores, immediately appealed to the liberal-minded Beard, who in 1892 wrote a "reform" novel himself. Dan noted that he had "more fun making the drawings for that book than any other book I ever illustrated." Part of the fun was the use of prominent people as "models" for the depicted characters. Beard, a staunch supporter of the economic ideas of Henry George, took great delight in using various "robber baron" industrialists of the day as some of Twain's villains. Other people did not share Twain's enthusiasm for these illustrations and the publishers were forced to delete the offending illustrations in later editions. As a result, Beard found his work boycotted for many years by most of the pro-

minent magazines. Nevertheless Beard's work was so highly regarded by his colleagues that in 1906 he was elected president of the Society of Illustrators.

In addition to his work as an illustrator, Beard also began teaching art. Like his uncle and brother, he always was interested in drawing animals. As an instructor at the Women's School of Applied Design in the '90's, he inaugurated the first organized class in animal drawing from life when he took his classes not only to zoos but to Buffalo Bill's Wild West Show. Dan's own vivid boyhood memories and experiences also prompted him to become a writer. His strong humanitarian proclivities made him realize the contrast between his own idyllic youth and the miserable existence of the New York street urchins of the type somewhat sentimentally depicted in the popular contemporary paintings of John George Brown and the famous stories of Horatio Alger. The sight of newsboys sleeping on wet paving stones one morning "started me on my lifelong crusade for American boyhood. I realized that I should not waste time on men, but hereafter devote all my energies to interesting boys." With this thought prompting him, he began writing as well as illustrating for popular children's magazines like *St. Nicholas*, *Harper's Round Table*, *Youth's Companion*, and *Hi-Wake*. Such articles as "How to Camp Without a Tent" proved so popular in *St. Nicholas* that his brother James urged him to collect all his contributions for a book. Accordingly Dan revised these articles, grouped them under the appropriate season of the year, and submitted the manuscript to Charles Scribner. This is, surprisingly enough, the only mention of the work in his autobiography, but the resulting book, *What to do and How to do it: The American Boys Handy Book*, immediately established Beard's reputation as a famous writer for boys. This book, first published in 1882, quickly became a best-seller and was kept in print for well over thirty years. Such sustained popularity gave the book the status of a children's classic—a fact recognized by the distinguished American bibliographer, Jacob Blanck, when he included it in his famous list of the 114 most beloved and influential juveniles of the nineteenth and early twentieth centuries. At least two and possibly three generations of American boys of the knicker age devoured this book—a fact which no doubt explains why copies of any of the many editions are so hard to find today.

Actually *The American Boys Handy Book* was by no means the first such book in its field. There were for instance Oliver Optic's edition of *Sports and Pastimes for In-Doors and Out* (1863), *The American Boy's Book of Sports and Games* (1865), both patterned after contemporary English books. While these previous books did include some games and sports, Beard struck an authentically American note by being the first writer to take his reader out to the fields and woods, the streams and lakes, and teach the arts, joys, and rewards of woodcraft, fishing and hunting, boating, and camping out-of-doors. With his own recollections of camping expeditions on the Licking River in the "Daniel Boone country" of Kentucky, Beard was able to offer much practical experience. For instance in his autobiography he relates the amusing incident of cooking eggs wrapped in a protective coating of blue clay. The eggs exploded because the young campers had forgotten to make safety holes in the eggs to allow the steam to escape. This same

story is repeated for the edification of the readers of *The American Boys Handy Book*. Other boyhood experiences recalled in the biography—the pleasures of making a dugout canoe, making traps and snares, constructing a rustic shelter and bed—all appear in the *Handy Book*. The descriptions of these suggested outdoor pastimes related with such contagious enthusiasm all contain detailed advice and instructions—a fact which Beard was careful to point out in the preface to the original edition.

Another distinctively American note to the book is Beard's emphasis in his preface on value of "doing-it-yourself"—"money spent on fancy sporting apparatus, toys, etc., would be better spent upon tools and appliances." Accordingly the reader is told how to keep busy making all sorts of engaging objects (many of which were later seized upon and patented by toy manufacturers)—a dozen different kinds of kites, six types of home-made fishing tackle, bird-singers and corn-stalk fiddles, blowguns and squirt guns, water telescopes, stilts, "Man Friday" rafts, and all types of equipment for winter fun—chair sleighs, snowshoes, and snowball ammunition sleds. Today's jaded youth who unmercifully tease their parents for the toys so seductively advertised on television, might profitably read *The American Boys Handy Book* and discover the fun and satisfaction of making some of this handicraft of a more innocent age. Some of Beard's projects were not so innocent, however. As the father of an active boy of ten, I certainly would pause before giving him instructions for making a "Booneo hunter's blowgun" despite the fact that clay balls are to be substituted for poisoned arrows! Most parents today also would take a dim view of Beard's spring shotgun for shooting bird shot, the boomerang, and "bird-bola"!

The American Boys Handy Book is not limited exclusively to outdoor activities, as Beard shows boys how to have fun inside. Part of the interest in reading the *Handy Book* today is its value as a social document, for here illustrated and described are such popular late nineteenth-century fads and pastimes as magic lantern and kaleidoscope shows, masquerades, taxidermy, "parlor exhibitions," "literary clubs" and even soap bubble parties! Of course Dan could tell his readers how to make the biggest and best bubbles! In his autobiography, he relates how in his Cincinnati home he discovered how to make enormous soap bubbles by attaching the pipe via a hose to an open gas-jet, and this boyhood discovery—dangerous as it may seem to the modern reader—is passed along to his youthful audience. Late Victorian domestic activities and handicrafts are fully described in the charming companion volume, *The American Girls Handy Book*, which Dan's sister Adelia (later a founder of the Girl Scouts) co-authored in 1887 for the "American boy's neglected sister."

The tremendous popularity of *The American Boys Handy Book* inspired Beard to write nearly twenty other books, most of which were devoted to nature lore and woodcraft. Permeated with his love of the outdoors, his books were avidly read by such men as Theodore Roosevelt and Gifford Pinchot who later told him that his passionate espousal of the "primitive wilderness, unmanicured, unshaven, without a haircut" helped impress them with the need for preserving America's forest land. Beard also helped advance the conservation crusade—a cause which is attracting such inter-

est today—when in the early 1900's he became editor of the magazine *Recreation*. In order to stimulate circulation, Beard, at the prompting of the business manager, established for his readers a society, "The Sons of Daniel Boone," (named after Dan's childhood hero) whose members, known as "scouts," were organized in clubs called "stockades" and "forts" throughout the country. The magazine was soon sold, but Beard took the Society with him when he joined the staff of *The Woman's Home Companion*. When Beard went on to *The Pictorial Review*, he started a similar organization, The Boy Pioneers. In 1910 both of Beard's groups were absorbed with his blessing into the Boy Scouts of America—the American counterpart of the original English organization of his friend "B-P"—General Robert Stephenson Smyth Baden-Powell.

One of the founding fathers of the Boy Scouts of America, Beard was chosen as National Vice-President and one of the three National Scout Commissioners—a post which he held until his death. Since *The American Boys Handy Book* had so much material on camping, woodcraft and knot-tying, Beard was naturally asked to write the first Scout handbook. Because of other commitments, he reluctantly declined and the job was assigned to his naturalist friend Ernest Thompson Seton, who added his romantic woodcraft and Indian lore to the English book already in existence. Beard, however, designed the scout costume and wrote and illustrated articles for the Boy Scout magazine, *Boy's Life*, until he died. It was through these articles that the name of "Uncle Dan" became known to millions of American boys. Here in *Boy's Life* appeared the somewhat stereotyped photographs of the still stalwart old man wearing his sombrero hat and buckskins seated beside a scout campfire or on a forest log. Through these pictures, Beard became so fully identified in the public mind with scouting that, as he noted with pique in his autobiography, "today few people know that I ever painted, exhibited and sold pictures at the water-color exhibitions, or even made illustrations. My connection with the Boy Scouts of America seems to have wiped my past history off the slate." These long years of service to scouting were recognized, however, when late in life he received the only Golden Eagle badge ever awarded, as well as having the peak adjoining Mt. McKinley in Alaska named in his honor. With all these encomiums in his lifetime, Beard's name is seldom heard today. It is high time, therefore, that we examine anew here the varied career and valuable service of Daniel Carter Beard. This new edition of his most famous book—*The American Boys Handy Book*—is indeed a fitting memorial to the life work of the old man of ninety who died in 1941 with the heart of a boy.

Charles V. S. Borst

PREFACE.

UNLESS boys have materially changed their habits in the last few years, it matters little what the preface of this book may contain, for it will be "skipped" without a passing glance. Still, in the established order of things, a preface, even if unno-

ticed by younger readers, is necessary to enable the author to state his purposes in undertaking the work, and to modestly put forward his claims on public attention.

It is the memory of the longing, that used to possess myself and my boy friends of a few years ago, for a real practical *American* boy's book, that has induced me to offer this volume.

The sports, amusements, and games embraced in this book are intended to reach the average American boy of any age, not too young to fly a kite or too old to enjoy a day's good fishing.

The book is based upon personal experiments and experiences, and is free, as far as lay within my power to make it, of foreign or technical terms or phrases.

Well do I remember the impracticable chemical experiments, necessitating professional skill and the use of complicated and expensive apparatus, the impossible feats of legerdemain and the time-worn conundrums, riddles, and games that help to make up the contents of the boy's books of my youth.

Unfamiliar and foreign terms, references to London shops as places to procure the articles mentioned, glittering generalities, and a general disregard for details are the marked characteristics of the books to which I refer.

Never shall I forget the disappointment experienced, when after consulting the index, I sought the article on paper balloons and found only the bare statement of the fact that balloons made of paper and filled with heated air *would ascend*. If I remember aright, the whole description occupies less than four lines.

Although the greater portion of the contents of the present volume has never been published before, some of it appeared as short articles in the *St. Nicholas Magazine*; and the directions and descriptions then given have been tested by thousands of boys throughout the United States, and, judging from the letters I have received, with uniform success.

Of course, such a book cannot, in the nature of things, be exhaustive, nor is it, indeed, desirable that it should be. Its use and principal purpose are to stimulate the inventive faculties in boys, to bring them face to face with practical emergencies when no book can supply the place of their own common sense and the exercise of personal intelligence and ingenuity.

Many new ideas will suggest themselves to the practical, ready-witted American boy, many simplifications and improvements on the apparatus here described; but it is hoped and expected by the author that the directions here given, as far as they go, will be found intelligible and practicable.

Nor is the volume, as is too often the case with this class of books, only to be made use of by lads with an almost unlimited supply of money at their disposal.

All apparatus described are either to be constructed of material easily obtained by almost any boy without cost, or by a very small outlay.

The author would also suggest to parents and guardians that

money spent on fancy sporting apparatus, toys, etc., would be better spent upon tools and appliances.

Let boys *make their own kites and bows and arrows*; they will find a double pleasure in them, and value them accordingly, to say nothing of the education involved in the successful construction of their home-made playthings.

The development of a love of harmless fun is itself no valueless consideration. The baneful and destroying pleasures that offer themselves with an almost irresistible fascination to idle and unoccupied minds find no place with healthy activity and hearty interest in boyhood sports.

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The American Boys Handy Book.

CHAPTER I.

KITE TIME.

It is a pleasant sensation to sit in the first spring sunshine and feel the steady pull of a good kite upon the string, and watch its graceful movements as it sway from side to side, ever mounting higher and higher, as if impatient to free itself and soar away amid the clouds. The pleasure is, however, greatly enhanced by the knowledge that the object skimming so bird-like and beautifully through the air is a kite of your own manufacture.

I remember, when quite a small boy, building an immense man kite, seven feet high. It was a gorgeous affair, with its brilliant red nose and cheeks, blue coat, and striped trousers.

As you may imagine, I was nervous with anxiety and excitement to see it fly. After several experimental trials to get the tail rightly balanced, and the breast-band properly adjusted, and having procured the strongest hempen twine with which to fly it, I went to the river-bank for the grand event.

My man flew splendidly; he required no running, no hoisting, no jerking of the string to assist him. I had only to stand on the high bank and let out the string, and so fast did the twine pass through my hands that my fingers were almost blistered.

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People began to stop and gaze at the queer sight, as my man rose higher and higher, when, suddenly, my intense pride and enjoyment was changed into something very like fright.

The twine was nearly all paid out, when I found that my man was stronger than his master, and I could not hold him!



Japanese Square Kite.

came carrying up from the ground toward my hands. So hard did my great pull that even the friend who had kindly come to the rescue had considerable trouble to hold him in. The great kite, as it swung majestically about, high in the blue sky, at-

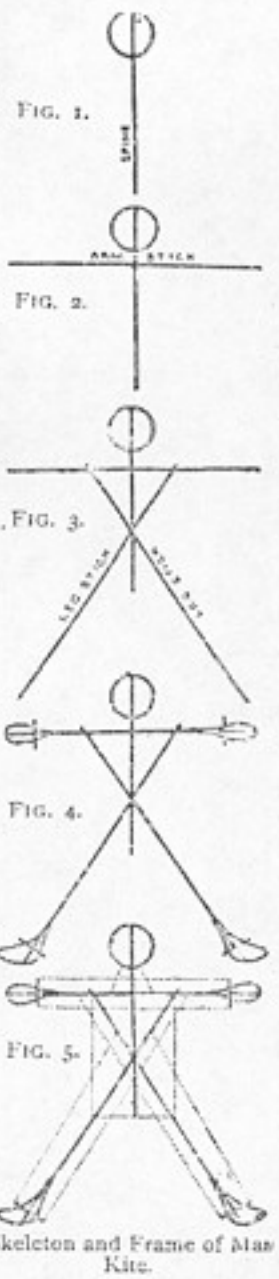
tracted quite a crowd of spectators, and I felt very grand at the success of my newly invented flying-man; but my triumph was short-lived. The tail made of rags was too heavy to bear its own weight, and, breaking off near the kite, it fell to the ground, while my kite, freed from this load, shot up like a rocket, then turned and came headlong down with such force, that dashing through the branches of a thorny locust-tree, it crashed to the ground, a mass of broken sticks and tattered paper. Although the sad fate of my first man-kite taught me

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to avoid building unmanageable giants, the experiment was, on the whole, satisfactory, for it proved beyond a doubt that it is unnecessary to follow the conventional form for a kite to make one that will fly.

Man Kite.

To make this kite you will require four sticks, some rattan and some paper. In regard to his size, I would suggest that the larger the man is, the better he will fly. Now let us suppose you are going to make this fellow four feet high. First, cut two straight sticks three feet nine inches long; these are to serve for the legs and body; cut another straight stick two and one-half feet in length for the spine, and a fourth stick, three feet five inches long, for the arms. For the head select a light piece of split rattan—any light, tough wood that will bend readily will do—bend this in a circle eight inches in diameter, fasten it securely to one end of the spine by binding it with strong thread, being careful that the spine runs exactly through the centre of the circle (Fig. 1). Next find the exact centre of the arm-stick, and with a pin or small tack fasten it at this point to the spine, a few inches below the chin (Fig. 2). After wrapping the joint tightly with strong thread, lay the part of the skeleton which



Skeleton and Frame of Man Kite.

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is finished flat upon the floor, mark two points upon the arm-sticks for the shoulder-joints, each seven inches from the intersection of the spine and arm-stick, which will place them fourteen inches apart. At these points fasten with a pin the two long sticks that are to serve for the body and legs (Fig. 3). Now cross these sticks as shown in diagram, being careful that the terminations of the lower limbs are at least three feet apart; the waist-joint ought then to be about ten inches below the arm-stick. After taking the greatest pains to see that the arm-stick is perfectly at right angles with the spine, fasten all the joints securely. Upon the arms bind oblong loops of rattan, or of the same material as the head-frame. These hand-loops ought to be about three inches broad at their widest parts, and exact counterparts of each other. The loops for the feet must approach as nearly as possible the shape of feet, and these, too, must be exactly alike, or the kite will be "lopsided," or unequally balanced. Now cut two sticks three inches long for the ends of sleeves, and two others four inches long for bottoms

of trousers (Fig. 4); fasten the two former near the ends of the arm-stick, and the two latter near the ends of the leg-sticks, as in the illustration. The strings of the frame must next be put on, as shown by the dotted lines (Fig. 5). Commence with the neck, at equal distances from the spine, and about seven inches apart; tie two strings to the arm-sticks; extend these strings slantingly to the head, and fasten them to the hoop, one on each side of the spine; and about five inches apart. Take another thread and fasten to the top of cross-stick of right arm, pass it over and take a wrap around the spine, continue it to top of cross-stick upon left arm, and there tie it. Fasten another string to bottom of cross-stick on right arm, draw it tight and wrap it on spine four inches below intersection of arm-stick, pass it on to the bottom of cross-stick on left arm, draw taut and fasten it. Tie the body-string at the right shoulder-joint, drop the thread down to a point exactly opposite the termination of spine upon the right leg, take a wrap, and draw the line across to point upon left leg exactly opposite, bind it there, then bring it up to left shoulder-joint and tie it. For the trousers fasten a string at a point on right arm-stick, eleven inches from the intersection of spine, extend it down in a straight line to inside end of cross-stick of left limb and fasten it there. Tie another string at a point one inch and a half to the left of spine upon right arm-stick, extend it down in a straight line to outside end of cross-stick of left limb. Go through the same process for right leg of trousers, and the frame-work will be complete.

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For the covering of a kite of this size I have always used tissue paper; it is pretty in color and very light in weight. Paste some sheets of tissue paper together, red for the trousers, hands and face, blue for the coat, and black, or some dark color, for the feet. Use paste made of flour and water boiled to the consistency of starch. Put the paste on with a small bristle brush, make the seams or over-laps hardly more than one-fourth of an inch wide, and press them together with a soft rag or towel; measure the paper so that the coat will join the trousers at the proper place. When you are satisfied that this is all right, lay the paper smoothly on the floor and place the frame of the kite upon it, using heavy books or paper-weights to hold it in place. Then with a pair of scissors cut the paper around the frame, leaving a clear edge of one-half inch, and making a slit in this margin or edge every six or seven inches and at each angle; around the head these slits must be made about two or three inches apart to prevent the paper from wrinkling when you commence to paste. With your brush cover the margin with paste one section at a time, turn them over, and with the towel or rag press them down. After the kite is all pasted and dry, take a large paint-brush, and with

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black marking-paint, india ink, or common writing fluid, put in the buttons and binding on coat with a good broad touch. The face and hair must be painted with broad lines, so that they may be seen clearly at a great height. Follow this rule wherever you have to use paint upon any kind of kite.

The breast-band, or "belly-band," of the man kite should be arranged in the same manner as it is upon the common hexagonal or coffin-shaped kite with which all American boys are fa-

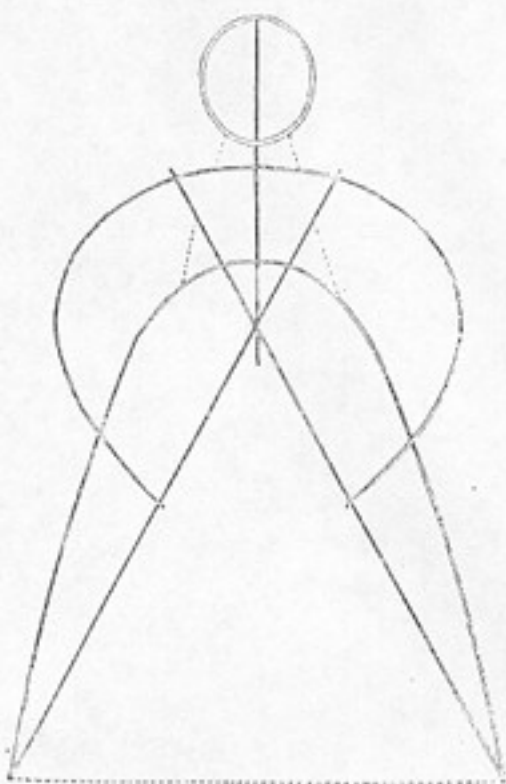


FIG. 6.—Frame of Woman Kite.

length as the first and fasten one end in the same manner at the bottom of the right leg, pass the string up, crossing the first band, and tie the end at the left shoulder. Attach your kite-string to the breast-band where the two strings intersect in such

miliar; but for fear some of my readers may not quite understand I will try and tell them exactly how to do it. First, punch small holes through the paper, one upon each side of the leg-sticks just above the bottom of the pants, and one upon each side of the arm-stick at the shoulders. Run one end of the breast-band through the holes at the bottom of the left limb and tie it fast to the leg-stick; tie the other end at the right shoulder. Take another string of the same

a manner that you can slide the kite-string up or down until it is properly adjusted. For the tail-band, tie a string (to the



FIG. 8.—Comic Girl Kite.

leg-sticks) at the bottom of the breast-band and let it hang slack from one leg to the other. Attach the tail to the centre of this string.



FIG. 7.—Foot of the Girl.

The Woman Kite, though differing in form, is made after the same method as the man kite, and with the aid of the diagram any boy can build one if he is careful to keep the proper proportions. Remember that the dotted lines in each of these diagrams represent the strings or thread of the framework (Fig. 6). Use small, smooth twine on large kites, and good strong thread on the smaller ones.

A very comical effect can be had by making the feet of the woman kite of stiff paste-board, and fastening them on to the line which forms the bottom of the skirt with a string after the manner here illustrated (Fig. 7), allowing them to dangle loosely from below, to be moved and swayed by each motion of the

10

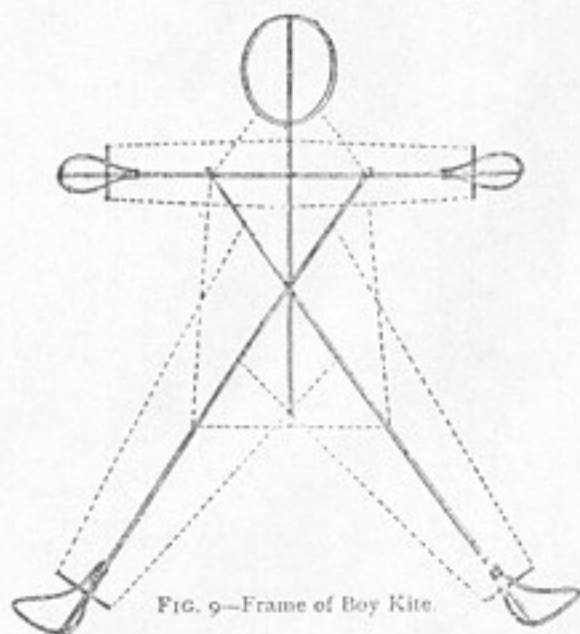


FIG. 9.—Frame of Boy Kite.

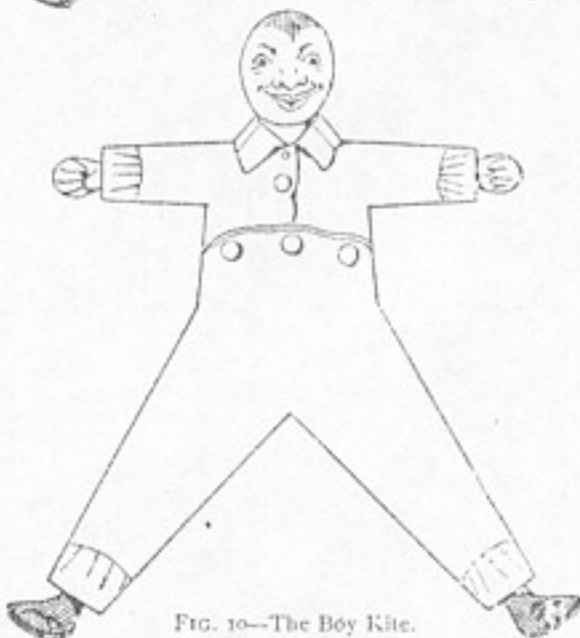


FIG. 10.—The Boy Kite.

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A Boy Kite

that will create an unlimited amount of fun whenever he makes his appearance in his æsthetic Kate Greenaway suit. By carefully following the construction according to the diagram (Fig. 9) the average boy will find little difficulty in building a twin brother to the kite in the illustration (Fig. 10).

Still another strange looking kite can be made by using a piece of pliable wood bent in a circular form for the body, and allowing the leg-sticks to protrude above the shoulders to form short arms, the spine extending below the trunk some distance to form the tail to a

Frog Kite.

It is not worth while to build one less than two feet high. Let us suppose that the particular batrachian we are now about to make is to be just that height; in this case the leg-sticks must be each two feet long, and as you will want to bend them at the knees, these points should be made considerably thinner than the other parts of the sticks. The spine must be about one foot seven inches long, or a little over three-quarters of the length of the leg-sticks. Place the two latter one above the other, lay the spine on top of them, and see that the tops of all three are flush, or perfectly even. Then at a point eight inches from the top, drive a pin through all three sticks, carefully clamping it upon the other side where the point protrudes. For the body, take a piece of thin rattan two feet five

kite, looking as if it was indeed a live woman or girl of the Kate Greenaway style, dancing and kicking in the clouds. Fig. 8 shows a girl kite with feet attached.

The costume given in the illustration may be varied according to fancy, with the same framework. A Dolly Varden or a Martha Washington costume can be made. A blue overskirt and waist covered with stars, and a red and white striped skirt, give us Columbia or a Goddess of Liberty. Attach the breast-band in the same manner as upon the man kite. Let the tail-band hang loosely below the skirt. By a slight modification of the frame of the man kite you can produce

or six inches in length, bend it into the form of a circle, allowing the ends to overlap an inch or two that they may be firmly bound together with thread by winding it around the joint. The circle will be about eight inches in diameter. Take the three sticks you pinned together and lay them on the floor, spreading them apart in the form of an irregular star, in such a

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manner that the top of the spine will be just half-way between the tops of the leg-sticks and about five inches from each; when you have proceeded thus far place the rattan circle over the other sticks; the intersection of the sticks should be the centre



FIG. 11.—Frame of Frog Kite.

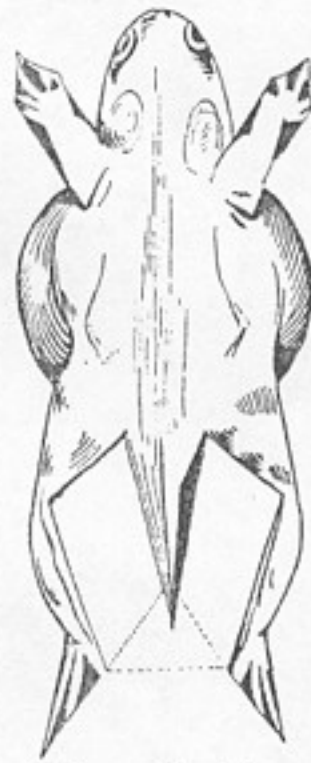


FIG. 12.—Frog Kite.

of the circle; with pins and thread fasten the frame together in this position. The lower limbs will be spread wide apart; they must be carefully drawn closer together and held in position by a string tied near the termination of each leg-stick. Cross-sticks for hands and feet may now be added, and the strings put on as shown in Fig. 11. This kite should be covered with green tissue paper. A few marks of the paint-brush will

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give it the appearance of Fig. 12. The breast and tail-band can be put on as described in the man kite.

The Butterfly Kite.

Make a thin straight stick of a piece of elastic wood, or split rattan; to the top end of this attach a piece of thread or string; bend the stick as you would a bow until it forms an arc or part of a circle; then holding the stick in this position tie the other end of the string to a point a few inches above the bottom end of the stick. At a point on the stick, about one-quarter the distance from the top, tie another string, draw it taut, and fasten it to the bottom end of the bow. Take another stick of ex-

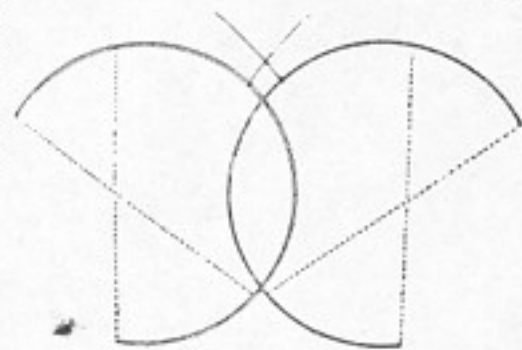


FIG. 13.—Frame of Butterfly Kite.

actly the same length and thickness as the first, and go through the same process, making a frame that must be a duplicate of the other. Then fasten the two frames together, as shown by Fig. 13, allowing the arcs to overlap several inches, and bind the joints securely with thread.

The head of the insect is made by attaching two broom-straws to the top part of the wings where they join, the straws must be crossed, the projecting ends serving for the antennæ or,

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as the boys call them, the "smellers" of the butterfly. Now select a piece of yellow or blue tissue paper, place your frame over it, cut and paste as directed in the description of the man kite. When the kite is dry, with black paint make some marking upon the wings similar to those shown in the illustration, Fig. 14; or, better still, cut out some pieces of dark colored paper in the form of these markings and paste them on, of course taking care to have one wing like the other (Fig. 14), as in nature.

The King Crab Kite.

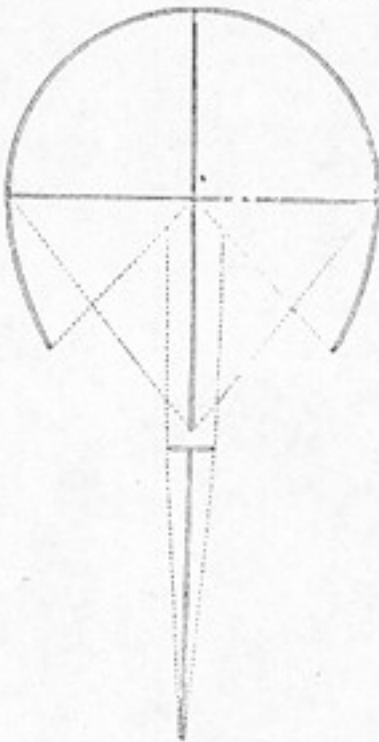


FIG. 15.—Frame of King Crab.



FIG. 16.—King Crab Kite.

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The king, or "horse shoe crab," is familiar to all boys who live upon the coast or spend their summer vacation at the sea-

side. It is a comparatively simple matter to imitate this crustacean in the form of a kite; in fact, all that is necessary is a slight modification of the old-fashioned bow kite to which a pointed tail must be attached. This tail can be made as shown in the illustration (Fig. 15), or may be cut out of a piece of paste-board and joined to the kite by a paper hinge; this will allow the tail to bend backward when the wind blows against it, giving it a natural appearance; the kite and pointed tail, which is part of the kite, should be covered with yellow paper. If you think that you do not possess sufficient skill with the brush to represent the under side of the crab, as shown in the



FIG. 14.—The Butterfly Kite.

illustration (Fig. 16), you can, at least, paint two large eye-spots some distance apart near the upper end, and then your kite will represent a back view. Attach the breast and tail bands as on an ordinary bow kite.

Fish Kite.

Cut two straight pine sticks; shave them down until they are thin enough to bend readily; see that they are exactly the same length and of about the same weight. Fasten the top ends together by driving a pin through them. Bend each stick in the form of a bow, and hold them in this position until you have secured a third stick across them at right angles about one-third the way down from the top, or ends where they are joined together. The fish should be about half as broad as it is long. Let the lower ends of the side or bow sticks cross each other far enough up to form a tail to the fish, and fasten the sticks together at their intersection. Before stringing the frame see that the cross-stick protrudes an equal distance from each side of the fish. To make the tail, tie a string across the bottom from the end of one cross-stick to the end of the other, and to this string midway between the two side-sticks tie another string, pass it up to the root of the tail, draw it taut

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and fasten it there at the intersection of the side-sticks; this will make a natural hooking-fork to the caudal fin (Fig. 17).

The remainder of the strings can be put on by referring to the diagram, care being taken that the dorsal or back-fin is made exactly the same size as the fin on the belly of the fish. Yellow, red, and green are all appropriate colors for the paper

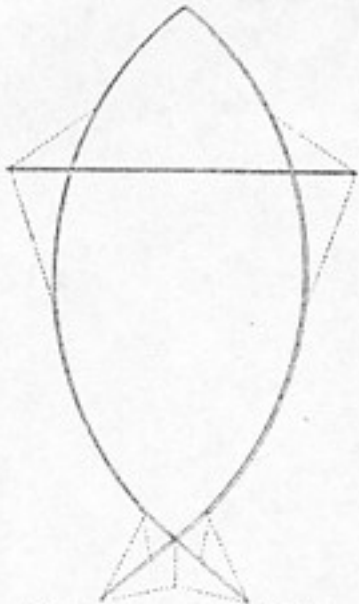


FIG. 17.—Frame of Fish Kite.



FIG. 18.—Fish Kite.

covering of this kite. After the paper is pasted and dry you may amuse yourself by painting the outlines of the gills and fins (Fig. 18). The kite will look all the better for not having the scales painted upon it. Tie the strings of the breast-band to the side-sticks near the head and tail, and let them cross each other as in a common kite. Attach the tail-band to the tail of the fish.

The Turtle Kite

is so simple in its construction that a lengthy description of how to make it would be out of place. All that is necessary

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is to place the diagram before you (Fig. 19) and go to work. Suppose you want your kite to measure two feet from tip of nose to end of tail, the spine or centre-stick must then, of course, be two feet long; make the leg-sticks each one and a half foot long, place the stick for the fore-legs at a point on the

spine seven inches below the top, put the stick for the hind-

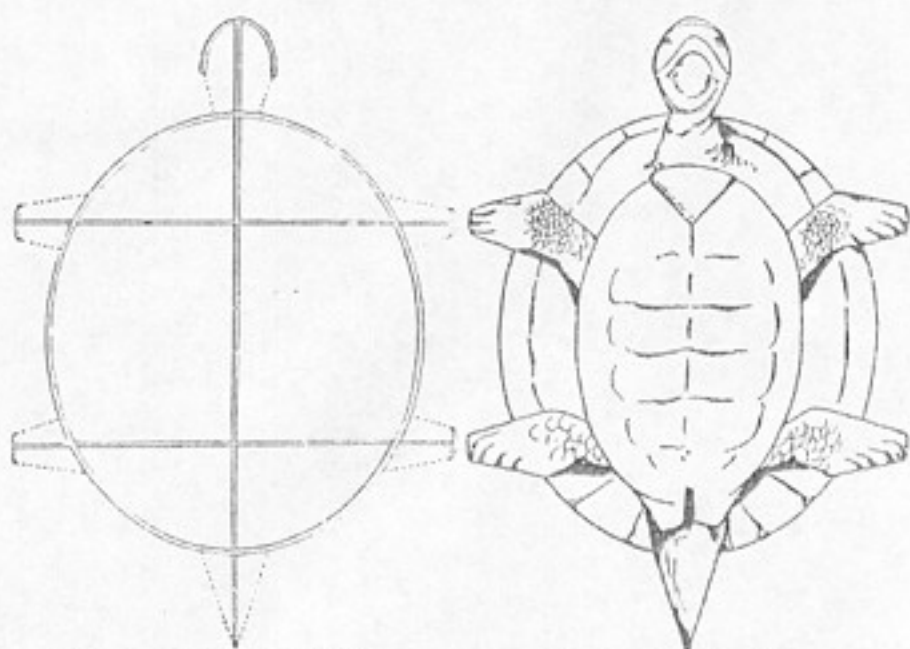


FIG. 19.—Frame of Turtle Kite.

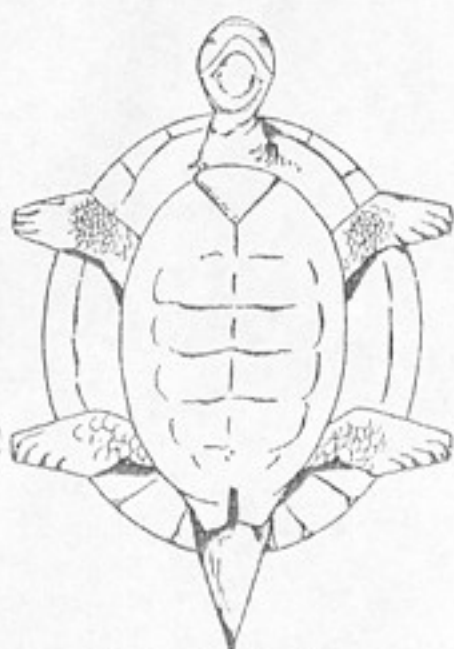


FIG. 20.—The Turtle Kite.

legs eight inches below the fore-legs. Adjust the hoop so that it will extend four inches above the fore-leg stick and the same distance below the hind-leg stick. Let the diameter across the centre from side to side be about fifteen inches. Put the cross-pieces on for the head and feet, run a thread over the bottom end of the spine for a tail, cover the whole with green tissue paper and your kite is done (Fig. 20).

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The Shield Kite.

Make the frame of four sticks, two straight cross-sticks and two bent side-sticks (Fig. 21); cover it with red, white, and blue



FIG. 21.—Frame of Shield Kite.



FIG. 22.—The Shield Kite.

tissue paper. Paste red and white paper together in stripes for the bottom, and use a blue ground with white stars for the top (Fig. 22). The next kite is not original with the author, but is

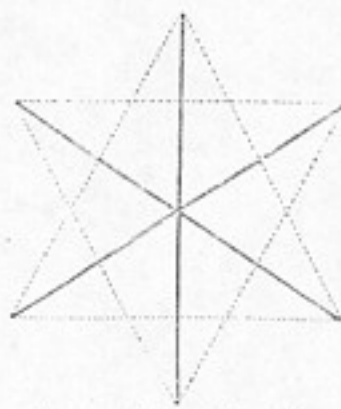


FIG. 23.—Frame of Star Kite.

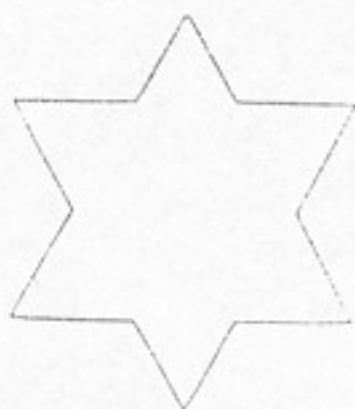


FIG. 24.—Star Kite.

well known in some sections of the country. I have made a diagram of it at the request of a number of boys who did not know how to make

19 A Star Kite.

Build it according to the diagrams (Figs. 23 and 24), making the sticks all of equal length, and cover the kite with any colored paper that may suit your fancy.

The Chinese Dragon Kite.

This kite is a most resplendent affair, and glitters in the sunlight as if it were covered with jewels. It is rather complicated to look at, but not very difficult to make. The one I have before me was made in China.

The top or horizontal stick (Fig. 25, 1-2) is three feet long, half an inch wide, and one-eighth inch thick. The face can be simplified by using a loop, as in the man kite. Two more loops, as shown in the diagram, will serve as frames for the wings. Paper is pasted upon this, and hangs loose like an apron in front below the cross-stick (1-2). Cut the paper long enough to cover the first

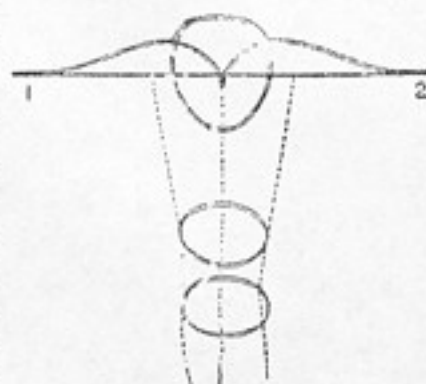


FIG. 25.



FIG. 26.

disk of the tail-piece, as shown in the finished kite, Fig. 27. The head-piece is ornamented with brilliant colors, bits of

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looking-glass pasted on or attached with strings, so that they dangle loosely, etc.; this makes the top rather heavy, as, in fact, it ought to be, for then it serves to balance the tail, which, in this instance, is a succession of circular kites, ten inches in diameter, and thirteen in number, connected with one another by strings. Attached to each of these paper disks is a slender piece of reed or grass with a tufted head; a similar tuft is fastened by a string to the opposite end to balance

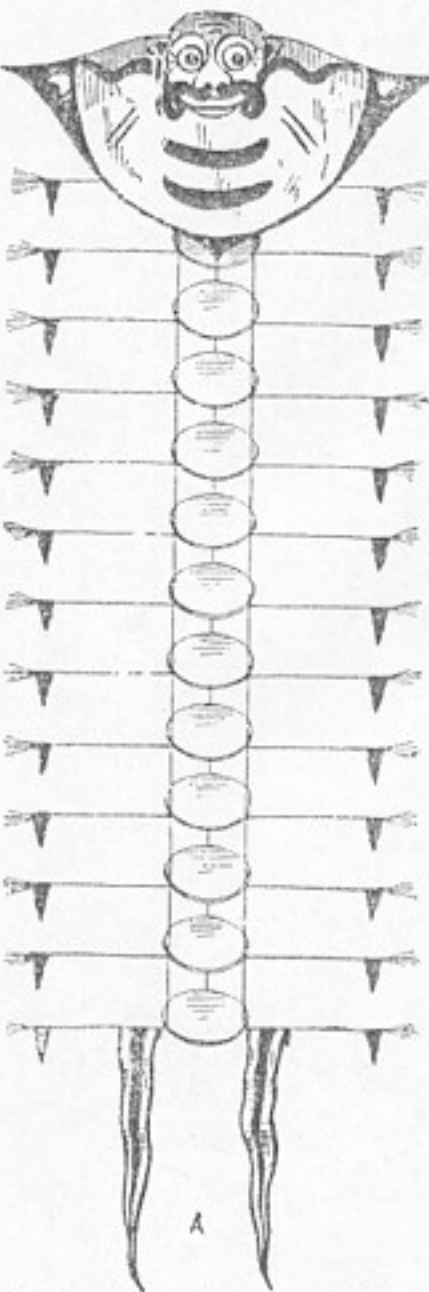


FIG. 27.—The Chinese Dragon Kite.



FIG. 27.—Portion of Framework of Tail.

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it. The breast-band is made like that upon an ordinary kite; the cross-strings, being attached to the face at the top and bottom, intersect each other about opposite a point between the eyes.

Fig. 26 represents the top view of a single disk, showing where the reeds and string are attached. Fig. 27 shows a side view of two disks, and the way in which they are connected by strings, six and a half inches space being left between each two disks. A (Fig. 27) is a front view of finished kite.

The Japanese Square Kite

is not, as its name might imply, perfectly square. It is rectangular in form, and made with a framework of very thin bamboo or cane sticks, bound together as shown in Fig. 28. This frame is covered with Japanese paper, to which all the sticks are tightly glued. The kite is bent backward, making the front slightly convex, and held in this position by strings tied from end to end of the cross-sticks at the back; the breast-band may be attached as on an ordinary six-sided kite. Instead of a tail-band, with a single tail attached, this foreigner carries two tails, one tied at each side to the protruding ends of the diagonal sticks at the bottom of the kite. The illustration on

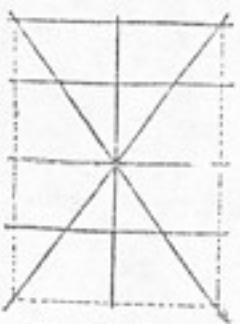


FIG. 28.—Japanese Square Kite Frame.

page 4, of two boys making ready to fly one of these kites, is a copy from a picture made by a Japanese artist.

The Moving Star

is a paper lantern attached to the tail of any large kite. A Chinese lantern will answer this purpose, although it is generally so long and narrow that the motion of the kite is apt to set fire to it.

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To make a more suitable lantern, take a circular piece of light board five inches in diameter, drive three nails in the centre just far enough apart to allow a candle to fit between them firmly. Make of rattan or wire a light hoop of the same diameter as the bottom-piece; fasten these to a strap or handle

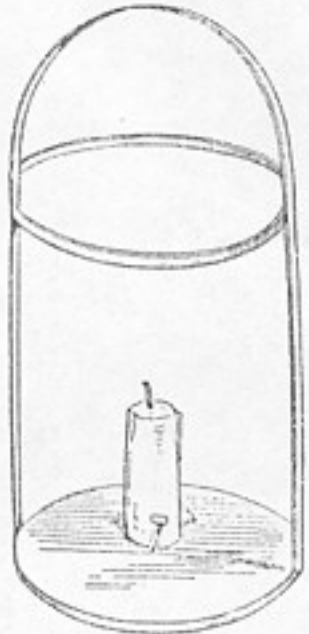


FIG. 29.—Frame of Lantern.

of wood, or wire, as shown in the diagram (Fig. 29), and cover the body of the lantern with red tissue paper.

This lantern fastened to the tail of a large kite that is sent up on a dark night will go bobbing around in a most eccentric and apparently unaccountable manner, striking with wonder all observers not in the secret.

CHAPTER II.

WAR KITES.

LIKE all soldiers, war kites should be trim and martial in appearance. Their uniform may be as brilliant and fanciful as the ingenuity and taste of the builder suggests, always remembering that lightness and strength are essential qualities. An appropriate name or emblem, marked, painted, or pasted on, would serve not only to distinguish the combatants from their more peaceful brother aërostats, but would give to each kite an individuality, and thus allow successful veterans to become famous throughout kitedom. There are but two "arms" to this novel "service," or rather two modes of warfare. The first, *unarmed*, might be compared to the friendly jousts of the knights of old when they met for trials of skill. The second, *armed*, is more like the mortal combat where but one survives.

Unarmed War Kite.

The usual form of the unarmed fighting kite is that of the ordinary bow kite. It should be made about two and one-half

feet high. Base of bow, fourteen inches below top of spine or centre-stick, and twenty-seven inches broad. Cover the frame with paper cambric. Make the tail of string, with stripes of colored paper inserted in loops an inch or so apart. A paper tassel at the end will give it a finished look. Ten feet is about the proper length of tail for a kite of this size.

In fighting with this unarmed soldier the object is to capture your opponent's kite by entangling its tail in your own

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string. To do this you must make your kite dart under the twine of your enemy. As soon as it darts let out string rapidly enough to keep your fighter under control, and at the same time allow it to fall to the rear of the other kite. Having accomplished this, drop your ball of string and pull in hand over hand, as fast as possible. If your enemy is not very spry and well up in these tactics, this manoeuvre will hopelessly entangle his kite-tail on your string. Then, although the battle is half won, a great deal depends upon your superior quickness, skill, and also upon the strength of your twine, which may break, or your victim may escape with the loss of part of its tail. If, however, you are successful in capturing your prisoner you can write on your kite the date of the victory, and the name of the vanquished warrior. The captive must, in all cases, be returned to its proper owner after the latter has signed his name to the record of his defeat written upon your kite. Thus is the successful hero soon covered with the records of his victories, while the unsuccessful fighter carries a bare blank face.

Armed Kites

are of a more relentless and bloodthirsty order than the strategic unarmed warrior. The peculiar mission of these rampant champions of the air is to cut the enemy off from his base of supplies; then with a satisfied wriggle, and a fiendish wag of the tail, this ferocious flyer sails serenely on, while his ruined victim falls helplessly to the earth, or ignominiously hangs himself on some uncongenial tree, where his skeleton will struggle and swing until beaten to pieces by the very element that sustained him in his elevation before his thread of life was cut. In this sport, new to most Northern boys, they will find an exciting and healthy pastime, one that will teach them to think and act quickly, a quality that when acquired may be of infinite service to them in after years.

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Armed Kite Fighting.

These aëro-nautical cutters might be appropriately named the Scorpion, "Stingerree," Wasp, or Hornet, because they fight with their tails, the sting of the insect being represented on the kite-tail by the razor-like cutters.

The tactics used in these battles of the clouds are just the opposite from those employed in fighting with unarmed kites.

To win the battle you so manoeuvre your warrior that its tail sweeps across and cuts the string of your antagonist.

Armed kites are usually made after the pattern of the American six-sided or hexagonal kite. They are two and one-half feet high, covered with paper cambric, or, when economy is no object, with silk.

As a successful warrior looks well after his arms, so should the tail of a war kite receive the most careful attention.

One very popular style of tail is made of strips of bright-colored cloth about one inch wide tied securely in the middle

to a strong twine, the tail ending in a fancy tassel.

Another style is made of long narrow strips of white cloth securely sewed together. This tail is not so apt to become knotted or tangled as the first.

How to Make the Knives.

The "cutters" to be attached to the tail are made of sharp pieces of broken glass called knives.

From a thick glass bottle, broken off below the neck, chip off pieces. This can be done with the back of a heavy knife blade or a light hammer. The workman cannot be too careful or cautious in breaking or handling the glass, as the least carelessness is sure to result in bad cuts and bloody fingers.

From the slivers or chips of glass select pieces thick on the outside curve, but with a keen sharp inside edge. It may take

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time, experience, and several bottles to get knives to exactly suit you.

How to Make Cutters.

Fasten three knives together with wax (Fig. 30) so that each shall point in a different direction, bind on this three slips of thin wood lengthwise to hold the wax and glass firmly, and cover it neatly with cloth or kid.

A piece of twine looped at each end should pass through the apparatus lengthwise. This, of course, to be put in before the slips are bound together. Excellent cutters can be made of blades from an old penknife.

A much simpler weapon is made with a piece of stout twine one foot long, dipped in glue and rolled in pounded glass until thickly coated with a glistening armor of sharp points. Two of these incorporated in the lower half of the kite's tail will be found to be effective cutters.

Boys participating in this war of kites should always bear in mind the fact that it requires but little skill to cut an unarmed kite, and that there is no honor or glory to be gained in vanquishing a foe who is unable to defend himself.

There are many other attachments, improvements, and amusing appliances that suggest themselves to an enthusiastic kite-flyer.

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Kite Clubs.

The field is a large one, and the opportunities for originality and ingenuity almost unbounded. If some enthusiastic, energetic boy will take the initiatory steps, kite clubs might be formed throughout the country with appropriate names, rules, and regulations, which, during the kite season, would have their meets and tournaments, and award prizes to the steadiest stander, the highest flyer, and the most original and unique design besides the prizes awarded at the jousts of the war



FIG. 30.—Cutters.

kites.

The organization of such clubs would give a new impetus to an amusement deserving of greater popularity than it has ever attained in this country.



Kite Time.

CHAPTER III.

NOVEL MODES OF FISHING.

The Bell Pole.

IN the Gulf States, upon some of the plantations that border the sluggish streams or bayous peculiar to that part of the country, the field hands have a simple and ingenious contrivance by which they are enabled to fish without interfering with the discharge of their duties.

The apparatus used consists of an ordinary cane-pole to which a long line with any number of hooks is attached; an old bell is hung at the end of the cane where the line is fastened.

The sable sportsmen set a number of poles, rigged in this manner, thrusting the butt ends of the rods into the soft bank so that they stand almost upright along the edge of the water upon which the plantation borders.

After the hooks are baited the lines are cast out as far as they will reach into the stream and left to take care of themselves. As soon as a fish is hooked it struggles to free itself, but the first plunge the unwary creature makes rings the bell at the end of the rod and summons the laborer from the field, who leaves his ploughing or planting just long enough to land the fish and re-bait the hook. It is seldom that the setting sun sees the dusky workmen return to their cabins empty-handed.

By far the oddest and most original mode of fishing practised by the colored people of the Southern States is called by them

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"Jugging for Cats."

Early one morning, while sauntering along the levee of a small town upon the Mississippi, the author met an old colored friend, Uncle Eanes.

"Whars I gvine?" queried the old man. "I was jus gwine to git de traps together to jug for cats,—Hi, Hi, neber

hea tell of dat? De Lor! no sah, not presactly pussy cats — cullored folks cats 'bout de same as white folks (when dey can git it). Yes, sah! we's seed purty tight times since de war, Suah! but we hasent come to eating pussy cats just yet, Boss! Hi, Hi! Take a big jug suah enough to hold a tolerable sized mud cat! but we don't cotch dem in de jugs. You jest come along and I'll show you how 'tis." Uncle Eanes's invitation was accepted, and the author was initiated into the mysteries of

"jugging for cats," which he found to combine exercise, excitement and fun in a much greater degree than the usual method of angling with rod and reel.

The tackle necessary in this sport is very simple; it consists of five or six empty jugs tightly corked with corn cobs, as many stout lines, each about five feet long with a sinker and large hook at the end. One of these lines is tied to the handle of



Jug Rigged.

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each jug. Fresh liver, angle worms, and balls made of corn meal and cotton, are used for bait; but a bit of cheese, tied up in a piece of mosquito netting to prevent its washing away, appears to be considered the most tempting morsel.

When all the hooks are baited, and the fisherman has inspected his lines and found everything ready, he puts the jugs into a boat and rows out upon the river, dropping the earthenware floats about ten feet apart in a line across the middle of the stream. The jugs will, of course, be carried down with the current, and will have to be followed and watched. When one of them begins to behave in a strange manner, turning upside down, bobbing about, darting up stream and down, the fisherman knows that a large fish is hooked, and an exciting chase ensues. It sometimes requires hard rowing to catch the jug, for often when the fisherman feels sure of his prize and stretches forth his hand to grasp the runaway, it darts off anew, frequently disappearing from view beneath the water, and coming to the surface again, yards and yards away from where it had left the disappointed sportsman.

One would think that the pursuit of just one jug, which a fish is piloting around, might prove exciting enough. But imagine the sport of seeing four or five of them start off on their antics at about the same moment. It is at such a time that the skill of a fisherman is tested, for a novice, in his hurry, is apt to lose his head, thereby losing his fish also. Instead of hauling in his line carefully and steadily, he generally pulls it up in such a hasty manner that the fish is able, by a vigorous flop, to tear himself away from the hook. To be a successful "jugger," one must be as careful and deliberate in taking out his fish as though he had only that one jug to attend to, no matter how many others may be claiming his attention by their frantic signals. The illustration shows how the line is rigged.

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The Dancing Fisherman

is another method of catching fish, in principle similar to juggling, by means of a jumping-jack, or small, jointed man, whose limbs are moved by jerking a string attached to them. This little figure is fastened to a stick, which is secured in an upright position on a float made of a piece of board. Through a hole in the float is passed the string attached to the figure, and tied securely to this are the hook and line. After the hook is baited, the float is placed on the surface of the water, and the little man, standing upright, is left to wait in patience.

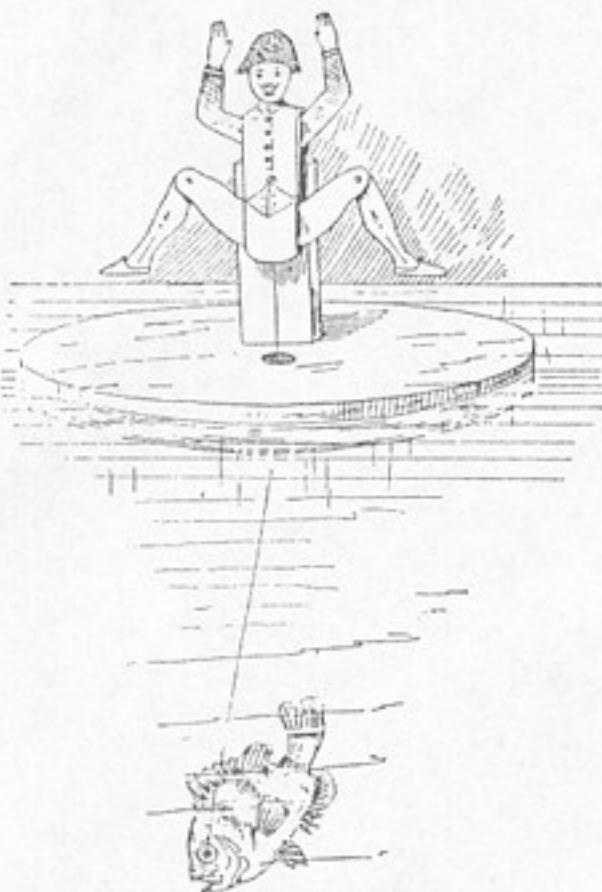


FIG. 31.

Presently a fish, attracted by the bait, comes nearer the surface, seizes the hook quickly, and darts downward, pulling the string, and making the little figure throw up its arms and legs as though dancing for joy at having performed its task so well. The capering of

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Jack is the signal to his master that a fish has been caught and is struggling to free itself from the hook. This manner of fishing is necessarily confined to quiet bodies of water, such as small lakes or ponds; for in rough water poor little Jack would be upset. Fig. 31 shows how to rig the "dancing fisherman."

Toy Boats for Fishing.

Trolling, by means of rudely made toy boats, is a sport the novelty of which will certainly recommend itself.

The boat can be made out of a piece of plank any where from a foot to two and one-half feet long, according to the size

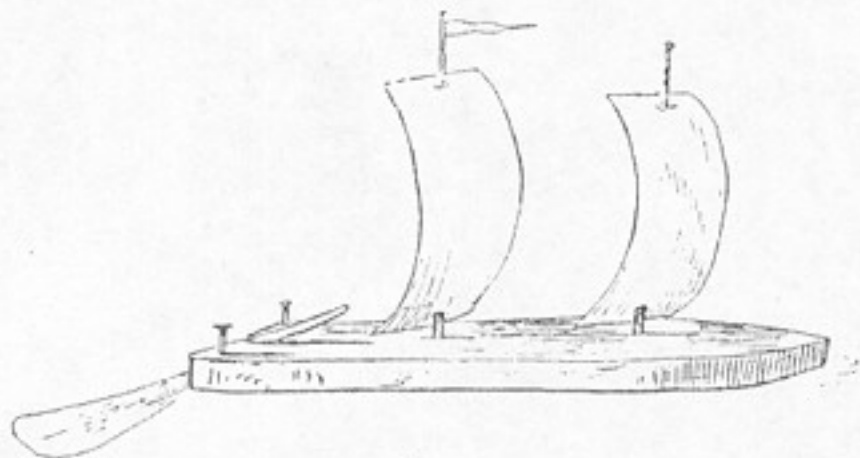


FIG. 32.

of the fish to be caught. Sharpen the plank at one end and rig it with one or two masts and sails of paper or cloth. The

rudder must be very long in proportion to the size of the boat, to prevent its making lee way and to keep it on a straight course. To nails in the stern of the boat tie fish lines rigged with spoon or live bait (Fig. 32). This diminutive fishing-smack will not alarm the finny inhabitants of the water as a larger boat might, but when sailing before the wind will troll

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the bait in a manner that appears to be irresistible to bass or pickerel, and sometimes even the mud-loving cat-fish will rise and swallow the hook. A whole fleet of these little vessels may be attended by one boy if he has a boat in which to row immediately to the assistance of any of his toy boats, whose suspicious movements betray the presence of a fish in tow.

The Wooden Otter

consists of a board two feet long, three inches wide, and one-half-inch thick, made to float on edge in the water by weighting the lower part of the plank with lead, iron, or even stones, tied on with strings. By means of a breast-band rigged like that on a kite, a strong tow-line is fastened to the "otter." At intervals along the tow-line, shorter lines are attached baited with artificial flies, spoon hooks, dead or live bait, as the case may be, the bait of course depending altogether upon the fish you are after. As you walk or row, the "otter" sheers off and the baits comb the water in a tantalizing way that is fatal to trout, bass, or pickerel. So "killing" is this instrument that it should only be used to replenish the larder when provisions are running short in camp.

Fishing for Fresh-Water Clams.

Mussels, or fresh-water clams, are prized by many boys on account of the pearly opalescent substance of which the shell is composed, it being an excellent material of which to make finger-rings and charms. Not unfrequently pearls of great beauty are found concealed within the shells of these bivalves.

The empty shells found upon the beach are never very highly prized, and are called by collectors dead shells. Shells of any kind which contain the living animal when collected, are ever after called live shells, for they still retain all their freshness and lustre after the inmate has been removed. To

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collect live mussel shells, you must wade, dive, or, if the water is clear enough for you to distinguish objects upon the bottom, fish for them, not with a hook and line, but with a long twig, from which all branches and leaves have been removed excepting a single bud on the end (Fig. 33). As soon as you detect a bivalve, you will discover its shells to be partially open.

Carefully insert the bud, that you have left upon the end of your stick, between the gaping lips of the shell, the instant



FIG. 33.



FIG. 34.

that the animal within feels the touch it will close its doors firmly, of course holding the switch between the shells. The bud at the end prevents the stick from slipping out, and the animal is caught by taking advantage of the very means it uses for protection.

A simple contrivance for catching small frogs, eels, and lizards, for the aquarium consists of an elder stick, with one end cut like a quill pen with the points spread apart, as shown in sketch (Fig. 34).

To use this you must approach a pond or brook very cautiously so as not to frighten your game. Through the clear water the little creatures can be seen resting quietly on the bottom. If you are careful not to make any disturbance or sudden movement you may get your elder lance poised over your lizard, newt, or frog, within an inch or so of its body, without disturbing him; then with a quick movement push the stick and animal both into the mud. On drawing out the stick you will find your captive squirming between the split ends of the

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elder—from which he can be removed without serious injury. With practice you can perfect yourself in this aquarian sport so as seldom to lose or injure your specimens.

The snare made of fine wire in the form of a slip noose is so well known to the boys in general, that it is no novelty and unnecessary to describe.



CHAPTER IV.

HOME-MADE FISHING TACKLE.

The Rod.

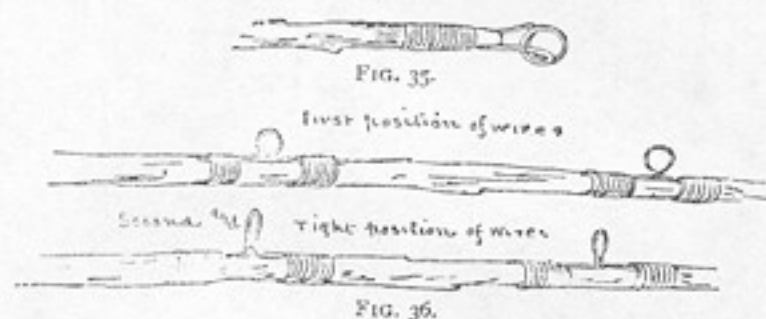
It not unfrequently happens that an amateur is unable to take advantage of most excellent fishing, for the want of proper or necessary tackle.

It may be that he is accidentally in the neighborhood of a pickerel pond or trout stream, or that his fishing tackle is lost or delayed in transit. Under such circumstances a little practical ingenuity is invaluable. If within reach of any human habitation you can, in all probability, succeed in finding sufficient material with which to manufacture not only a rod which will answer your purpose, but a very serviceable reel. To rig up a home-made trout rod, you need a straight, slender, elastic

pole, such as can be found in any wood or thicket, some pins, and a small piece of wire. File off the head of several pins, sharpen the blunt ends, and bend them into the form of the letter U. At a point about two feet from the butt end of the rod drive the first pin, leaving enough of the loop above the wood to allow the fish line to pass freely through; drive the other pins upon the same side of the rod and at regular intervals. Make the tip of a piece of wire by bending a neat circular loop in the centre, and then knitting or binding the wire on the end of the pole (Fig. 35). Should you have enough wire, it will answer much better for the other loops than the pins. If at a farm-house look in the attic for an old bonnet frame, or some similar object likely to be at hand, and it will furnish you with plenty of material. Cut the wire in pieces about two and

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a half inches long, make a simple loop in the centre of each piece, and with a "waxed end" or strong thread bind the ends of the wire lengthwise on the rod, then give each loop a



turn, twisting it in proper position (Fig. 36). With a large wooden spool, an old tin can, and a piece of thick wire, a first-rate reel may be manufactured.

Tin and Spool Reel.

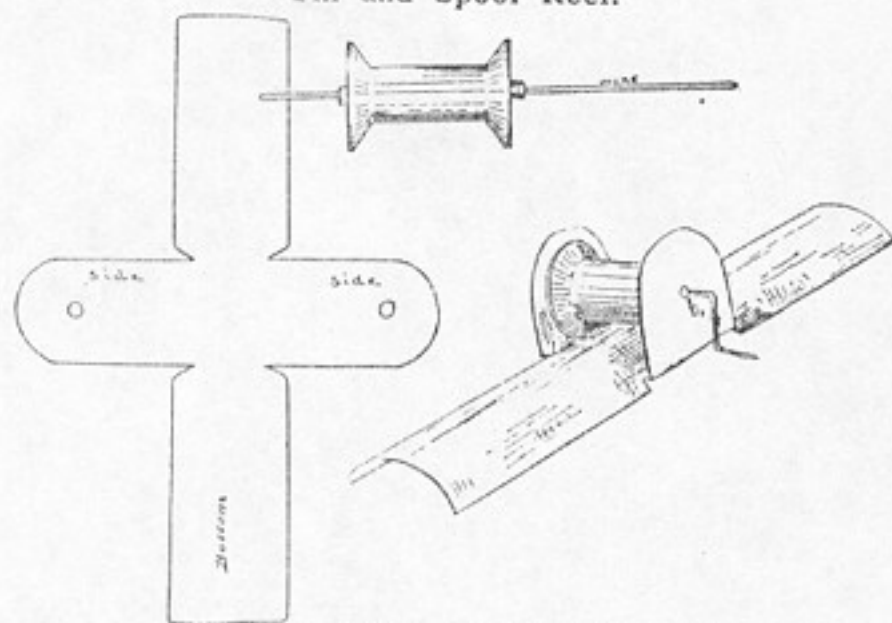


FIG. 37.—Construction of the Tin and Spool Reel.

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Put the wire through the spool, allowing about one inch to protrude at one end and about three inches at the opposite end. Wedge the wire in firmly by driving soft pine sticks around it, and trim off the protruding ends of the sticks. Cut a piece of tin in the shape shown by the diagram (Fig. 37), punch a hole in each side piece for the wire to pass through, leaving plenty of room for the spool to revolve freely. Turn the side-pieces up upon each side of the spool, and bend the long end of the wire in the form of a crank. Hammer the bottom piece of tin over the rod until it takes the curved form, and fits tightly, then with strong wax string bind it firmly to the rod. If it should happen that a piece of tin could not be procured, a reel can be

made of a forked stick and a spool.

The Forked-Stick Reel.

Cut a forked stick and shave off the inside flat, as in Fig. 38, cut two notches near the bottom, one upon each side; this



FIG. 38.

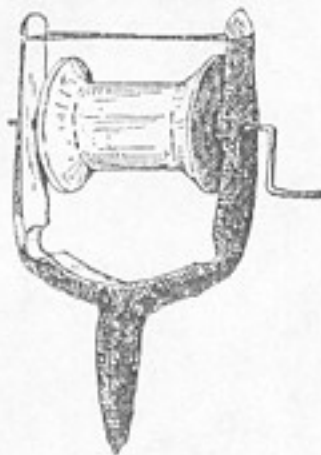


FIG. 39.

will allow the fork to bend readily at these points. Make a small groove for a string at the top of each prong. Put the spool

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between the prongs, allowing the wire to protrude through holes bored for that purpose. Bend the long end of the wire in the form of a crank. Tie a string across from end to end of the prongs to hold them in proper position, and you have a rustic but serviceable reel (Fig. 39). It may be attached to the pole in either manner shown by Figs. 40 and 41. Boys who find

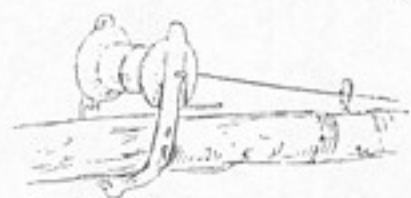


FIG. 40.



FIG. 41.

pleasure in outdoor sports should always be ready with expedients for any emergency. A fish hook is rather a difficult thing to manufacture, though I have seen them made of a bird's claw bound to a piece of shell by vegetable fibre. I would not advise my readers to attempt to make one. A better plan is to always carry a supply about your person, inside the lining of your hat being a good place to deposit small hooks. For black bass, pickerel, and many other fish, live minnows are the best bait. To catch them you need a net.

Home-Made Nets.

A simple way to make a minnow net is to stretch a piece of mosquito netting between two stout sticks. If deemed necessary, floats may be fastened at the top and sinkers at the bottom edge of the net (Fig. 42). Coarse bagging may be used if mosquito netting is not obtainable. But with a forked stick and a ball of string for material, a jack-knife, and your fingers for tools, a splendid scoop-net can be made that will not only last, but be as good, if not better, than any you could purchase. Cut a good stout sapling that has two branches (Fig. 43). Trim

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off all other appendages, and bend the two branches until the ends overlap each other for some distance, bind the ends firmly and neatly together with waxed twine, if it can be had—if not, with what string you have (Fig. 44).

Fasten the pole in a convenient position so that the hoop

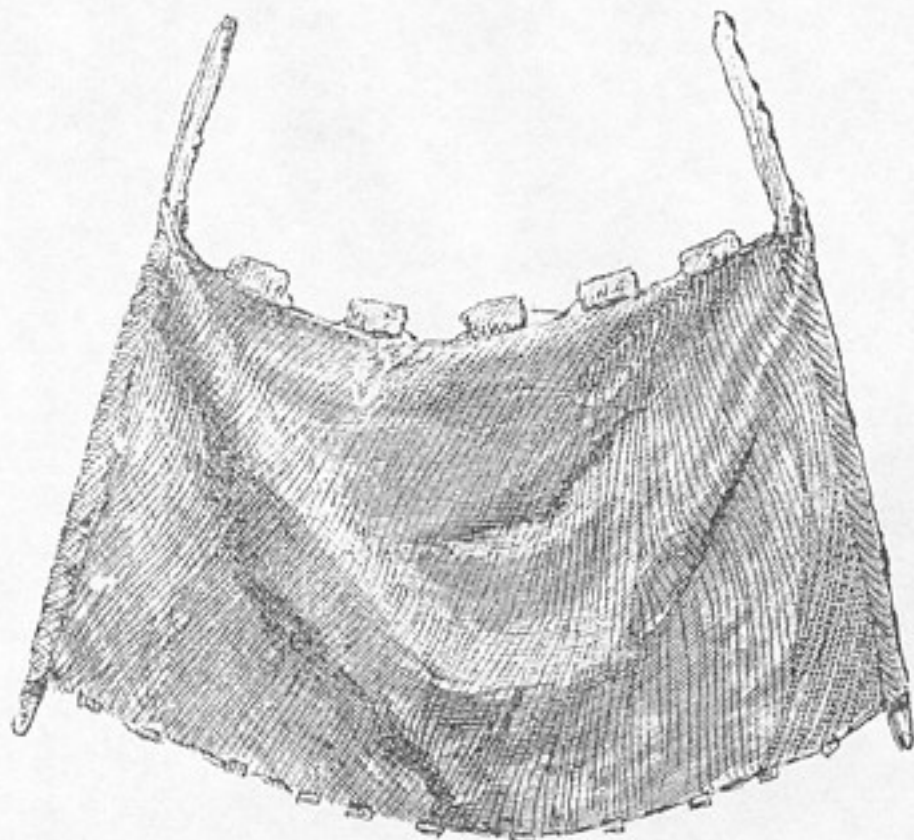


FIG. 42.

is about level with your face. If you want the net two feet deep, cut a number of pieces of twine seven or eight feet long, double them, and slip them on the hoop in the manner shown by the first string (Fig. 45).

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Beginning at the most convenient point, take a string from each adjoining pair and make a simple knot of them, as shown

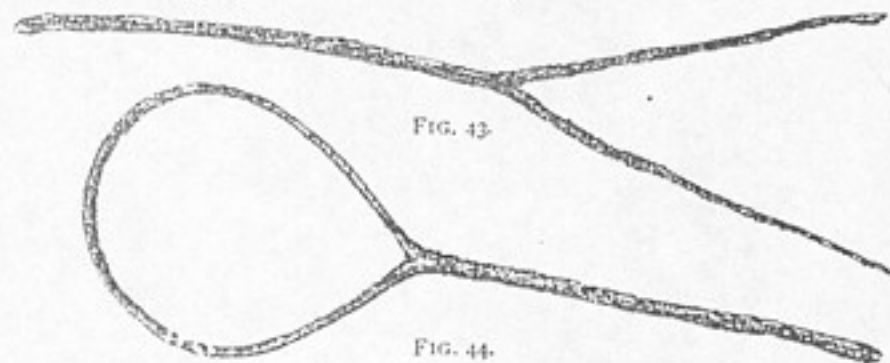


FIG. 43.

FIG. 44.

by the diagram. Continue all the way around the hoop knotting the strings together in this manner. Then commence on the next lower row and so on until you reach a point where, in your judgment the net ought to commence to narrow or taper down. This can

be accomplished by knotting the strings a little closer together, and cutting off one string of a pair at four equidistant points in the same row. Knot as before until you come to a clipped line; here you must take a string from each side of the single one and knot them, being careful to make it come even with others in the same row. Before tightening the double knot pass the single string through, and after tying a knot close to the double one cut the string off



FIG. 45.

close. (See Fig. 45 A.)

Continue as before until the row is finished, only deviating
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from the original plan when a single string is reached. Proceed in a like manner with the next and the next rows, increasing the number of strings eliminated until the remaining ones meet at the bottom, being careful not to let one drop mesh come directly under another of the same kind.

A scoop-net can be made of a piece of mosquito netting by sewing it in the form of a bag, and fastening it to a pole and hoop made of a forked stick like the one just described.

Minnows must be kept alive, and tin buckets, with the top half perforated with holes, are made for that purpose. These buckets, when in use, are secured by a string and hung in the water, the holes in the sides allowing a constant supply of fresh breathing material to the little fish within.

A Home-Made Minnow Bucket.

Take any tin bucket that has a lid to it and punch holes in the top and upper part with a nail and hammer, or some similar instruments. If a tin bucket cannot be had, a large-sized tin can will answer the purpose. The illustration (Fig. 46) shows a minnow bucket made in this manner. Fig. 47 shows the proper manner of baiting with a live minnow. The cartilaginous mouth of a fish has little or no feeling in it. A hook passed from beneath the under jaw through it and the upper lip will neither kill nor injure the minnow. As it allows the little creature to swim freely, there is a much greater chance of getting a bite than with a dead or mangled bait. The latter is a sign of either cruelty or ignorance on the part of the fisherman.

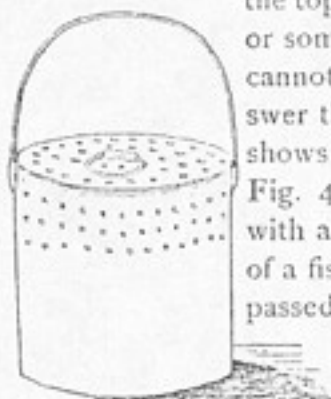


FIG. 46.

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Inhabitants of the Water.

How natural it is to speak of a love for the sea, or an intimate acquaintance and knowledge of the ocean, when, in reality, it is only the top or surface of the water that is meant, while the hidden mysteries that underlie the billows, the sea-world proper—its scenery, inhabitants, and history—are but



FIG. 47.

partially known, except to our most learned naturalists. The occasional glimpses we have of queer and odd specimens kidnapped from this unknown realm make it natural for us to feel a curiosity to know and a desire to see the life and forms that are concealed beneath the waves.

What boy can sit all day in a boat, or upon the green shady bank of an inland stream, watching the floating cork of his fish line without experiencing a longing for some new patent transparent diving bell, in which, comfortably ensconced at the bottom of the water, he might see all that goes on in that unfamiliar country.

In the next chapter I propose to show how this natural

curiosity or desire for knowledge may be gratified, not exactly by placing you at the bottom of the water, but by transporting a portion of this curious world, with its liquid atmosphere and living inhabitants into your own house, where you may inspect and study it at your leisure.

CHAPTER V.

HOW TO STOCK, MAKE, AND KEEP A FRESH-WATER AQUARIUM.

ALTHOUGH marine animals may surpass the inhabitants of fresh water in strangeness of form and tint, there are some fresh-water fish upon whom Mother Nature appears to have lavished her colors; and there are enough aquatic objects to be found, in any stream or pond, to keep all my readers busy and happy for years in studying their habits and natural history. One must have a certain amount of knowledge of the habits of an animal before he can expect to keep it in a thriving condition in captivity. This knowledge is gained by observation, and success depends upon the common sense displayed in discreetly using the information thus obtained.

Do not make the common mistake of supposing that an aquarium is only a globe or ornamental tank, made to hold a few lazy gold-fish. Do not have china swans floating about upon the top of the water, nor ruined castles submerged beneath the surface. Such things are in bad taste. Generally speaking, ruined castles are not found at the bottoms of lakes and rivers, and china swans do not swim on streams and ponds. If you determine to have an aquarium, have one whose contents will afford a constant source of amusement and instruction—one that will attract the attention and interest of visitors as soon as they enter the room where it is. Sea-shells, corals, etc., should not be used in a fresh-water aquarium; they not only look out of place, but the lime and salts they

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contain will injure both fish and plant. Try to make your aquarium a miniature lake in all its details, and you will find the effect more pleasing to the eye. By making the artificial home of the aquatic creatures conform as nearly as possible to their natural ones you can keep them all in a healthy and lively condition.

At the bird-stores and other places where objects in natural history are sold, you may buy an aquarium of almost any size you wish, from the square tank with heavy iron castings to the small glass globe; the globes come in ten sizes.

Some time ago, when the author, then quite a small boy, was spending the summer upon the shores of Lake Erie, the older members of the household frequently went out on the lake after black bass, taking with them for bait a pail of the beautiful "painted minnows" found in the little brooks of Northern Ohio. Upon the return of a fishing party the minnows left in the pail were claimed by the children as their share of the spoils, but the little fish would scarcely live a day; in spite of all that could be done they would, one by one, turn upon their backs and expire. This was the source of much disappointment and remorseful feelings on the part of the children. One day half the minnows from the pail were poured into a large flat dish, that they might be better seen as they swam about; here they were forgotten for the time; on the morrow all the fish in the pail were found to be dead, but those in the flat dish were per-

fectly lively and well. This discovery led to a series of experiments which the author has continued at times up to the present date, and he feels no hesitancy in saying that, if the manufacturers of aquariums in this country had made it their object to build vessels in which no respectable fish could live, they could hardly have succeeded better, for they all violate this first rule: the greater the surface of water exposed to the air, the greater the quantity of oxygen absorbed from the

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atmosphere. Amateurs must bear in mind that "the value of water depends not so much on its bulk as on the advantageous distribution of its bulk over large spaces." In other words, flat, shallow vessels are the best.

In the light of this fact the author set to work to build his first aquarium. The materials for its construction were bought of the town glazier's son. The amount paid was several marbles, a broken-bladed Barlow knife, and a picture of the school teacher sketched in lead pencil upon the fly-leaf of a spelling-book. In exchange for these treasures, several fragments of window-glass, some paint, an old brush, and a lump of putty, was received. Two or three days' work resulted in the production of an aquarium. It was only twelve inches long, eight inches wide, and four inches high; but, although this tank was small, it was a real aquarium, and would hold water and living pets. A piece of glass 12 x 8 inches formed the bottom. The sides were fastened on by simply pasting paper along the outside edges; if left in this condition of course the water would leak through the cracks, soften the paper, and produce disastrous results.

To prevent this the cracks upon the inside were carefully puttied up and the putty covered with thin strips of glass, which the glazier good-naturedly cut for the purpose; this not only prevented the tank from leaking, but added greatly to its strength. The paper corners and all the outside, excepting the front was then covered with two or three coats of paint. The front glass was left clean for observation. A piece of pine board formed the base of the little aquarium. After it was carefully puttied around the bottom, where the glass set in the board, the latter was nicely painted to correspond with the rest of the structure, the whole was left to dry. Crude as this tank may appear from the description, it did not look so, and best of all it never leaked.

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With a dip-net, made of an old piece of mosquito-netting, what fun it was to explore the spaces between the logs of the rafts in front of the old saw-mill! and what curious creatures were found lurking there! Little gars, whose tiny forms looked like bits of sticks; young spoon-bill fish (paddle-fish), with exaggerated upper lips one-third the length of their scaleless bodies; funny little black cat-fish, that looked for all the world like tadpoles, and scores of other creatures. Under the green vegetation in those spaces they found a safe retreat from the attacks of larger fish.

If a constant supply of fresh water can be kept flowing in an aquarium, or the water constantly aerified by agitation, the ordinary misshapen tank may be run successfully. The glass globe, the most unnatural of all forms for aquariums, can be utilized in this way. There used to be in the window of

a jewelry store, in an Ohio town, an ordinary glass fish-globe, in which lived and thrived a saucy little brook trout. Brook-trout, as most of my readers know, are found only in cool running water, and will not live for any great length of time in an ordinary aquarium. In this case, an artificial circulation of water was produced by means of a

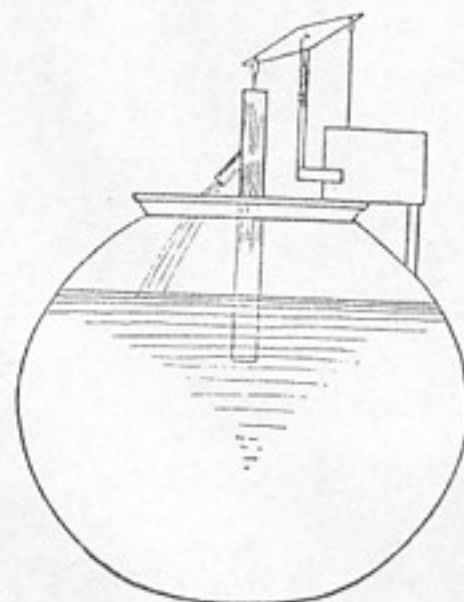


FIG. 48.—Globe and Pump.

little pump run by clock-work. Every morning the jeweller wound up the machine, and all day long the little pump worked, pumping up the water from the globe, only to send it back

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again in a small but constant stream which poured from the little spout, each drop carrying with it into the water of the globe a small quantity of fresh air, including, of course, oxygen gas. (See Fig. 48.) And the little speckled trout lived and thrived, and, for aught I know to the contrary, is still swimming around in his crystal prison, waiting, with ever-ready mouth, to swallow up the blue-bottle flies thrown to him by his friend the jeweller. It is a great mistake to suppose that it is necessary to change the water in an aquarium every few days. The tank should be so arranged as to seldom if ever require a change of water. This is not difficult to accomplish.

If possible, have your aquarium made under your own eyes. Suppose you wish one, two feet long; then it should be sixteen inches wide and seven inches high; or 24" x 7" x 16". Figure 49 shows an aquarium of the proper form and proportions.

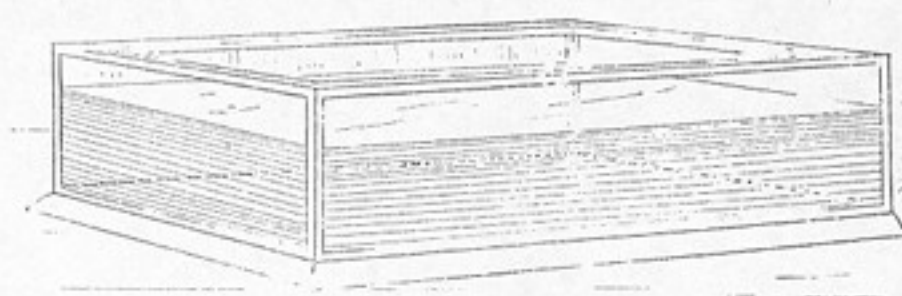


FIG. 49.

Figure 50 shows the popular, but unnatural and improper form. With a properly made aquarium, after it is once stocked with the right proportion of plant and animal life, there is no necessity of ever changing the water.

Both animals and plants breathe, and what is life to the plant is poison to the animal. Animals absorb oxygen and throw off carbonic acid gas; this gas the plants inhale, separating it into carbon and oxygen, absorbing the carbon, which is

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converted into their vegetable tissue, and throwing off the free oxygen for the animals to breathe. By having plants as well as animals in your tank, both classes are supplied with breathing material. When you start your aquarium, first cover the bottom with sand and gravel. Then build your rockery; it is better to cement it together and into place.

After this is all arranged, go to the nearest pond or brook, and dredge up some water plants. Any, that are not too large, will do—starwort, milfoil, bladder-wort, pondweed, etc. Fast-

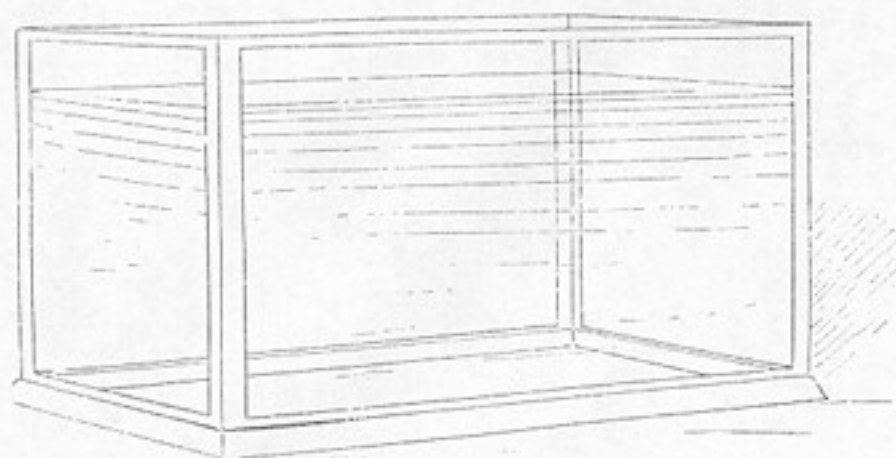


FIG. 50.

en the roots of your plants to small stones with a bit of string, and arrange them about the tank to suit your taste. Fill the tank with water, and let it stand in the window for a week or two, where it will receive plenty of light and but little sun. By that time all your plants will be growing, and numerous other little plants will have started into life of their own accord. Then you may add your animals, and, if you do not overstock the tank, you need *never change the water*. Be sure not to handle the fish; if, for any cause, you wish to remove them, lift them gently with a dip-net.

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Should you wish to keep a little turtle, a crawfish, or any such animal, you must have your rockery so arranged that part

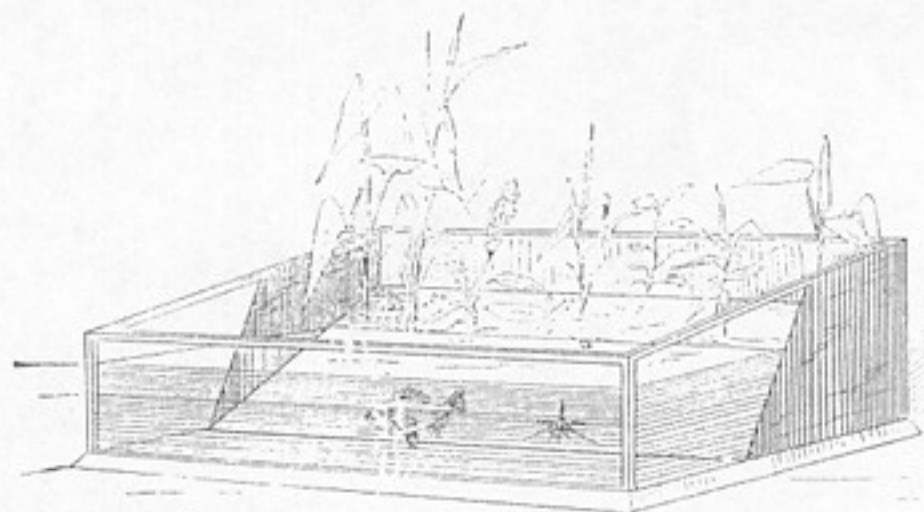


FIG. 51.

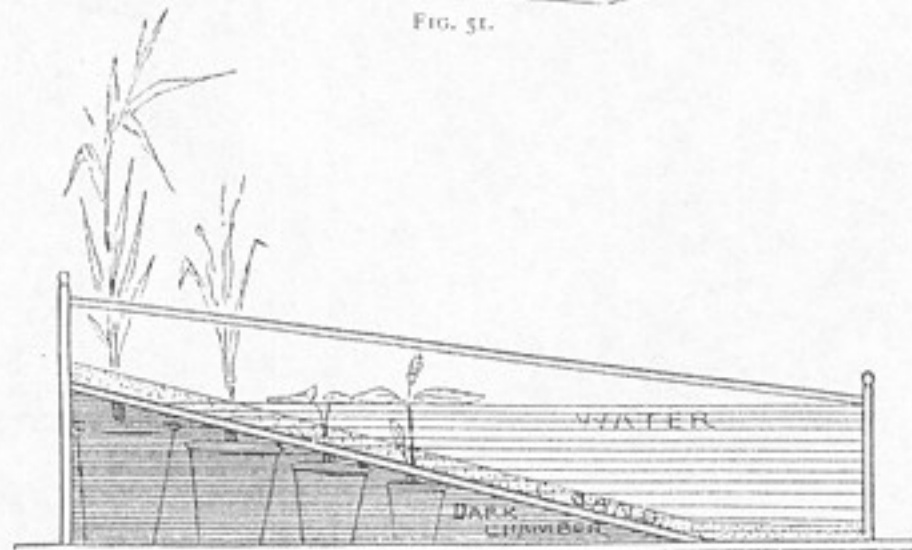


FIG. 52.

of it will protrude above the water; or, better still, have a vivarium or land-and-water aquarium, such as is shown in Figures 51

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and 52. With a tank made upon this plan you can have aquatic plants as well as land plants and flowers, a sandy beach for the turtle to sleep upon, as he loves to do, and a rockery for the crawfish to hide in and keep out of mischief. Some species of snails like to crawl occasionally above the water-line. Such an aquarium makes an interesting object for the conservatory.

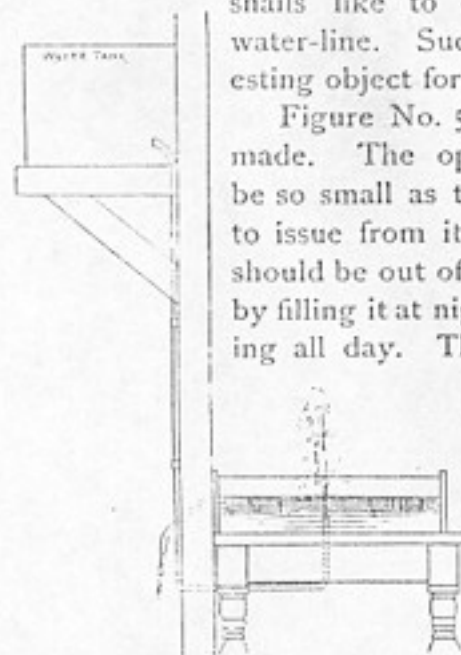


FIG. 53.

Figure No. 53 shows how a fountain can be made. The opening of the fountain should be so small as to allow only a fine jet of water to issue from it; the reservoir or supply-tank should be out of sight, and quite large, so that, by filling it at night, the fountain will keep playing all day. The waste-pipe should open at the level you intend to keep the water, and the opening should be covered with a piece of mosquito-netting or wire-gauze to prevent any creature from being drawn in.

In an aquarium with a slanting bottom, only the front need be of glass; the other three sides can be made of slate, which is also a good material for the false bottom. In ponds, rivers, and lakes, the only light received comes from above; so we can understand that a vessel admitting light upon all sides, as well as from the top, forms an unnaturally luminous abode for fish. The glass front is sufficient for the spectator to see through.

The author has a tank twenty-five inches long, eleven inches wide, and twelve inches high—far too narrow and deep; but these defects have been, in a measure, overcome by filling it only two-thirds full of water, and allowing the green vegetation

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to grow undisturbed upon three sides of the aquarium; the remaining side is kept clean by rubbing off all vegetable matter once a week with a long-handled bottle-washer. A rag or a piece of sponge, tied upon the end of a stick, will answer the same purpose. This tank has been in a flourishing condition for three years, and the water has been changed only once, and then all the water was removed so that some alteration could be made in the rockery.

But one of the inmates has died since last summer, and that was a bachelor stickleback, who probably received a nip from the pincers of one of the craw-fish. Two of these creatures have their den in the rockery that occupies the centre of the tank. A German carp, from the Washington breeding-ponds, browses all day long upon the mossy surface of the rocks, or roots around the bottom, taking great mouthfuls of sand and then puffing it out again like smoke. A striped dace spends most of his time lying flat upon his stomach on the bottom, or roosting like some subaqueous bird upon branches of the aquatic plants or on a submerged rock. A big and a little "killie" dart around after the boat-bugs, which they seldom catch; and if they do, they drop them again in great trepidation. A diminutive pond-bass asserts his authority over the larger fish in a most tyrannous manner. An eel lives under the sand in the bottom, and deigns to make his appearance only once in several months, much to the amazement of the other inhabitants, all of whom seem to forget his presence until the smell of a bit

of meat brings his long body from his retreat. Numerous little mussels creep along the bottom; periwinkles and snails crawl up and down the sides; caddice-worms cling to the plants, and everything appears perfectly at home and contented.

And why? Because their home is arranged as nearly as possible like their natural haunts, where they were captured. *Learn the habits of any creature, and give it a chance to follow*

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them, and you will find little difficulty in keeping it healthy in captivity.

Stocking.

Feed your fish on insects once or twice a week. Do not try to force them to eat; if they are hungry, they need little persuasion. Boat-bugs, whirligig-beetles, and, in fact, almost all the aquatic bugs and beetles, will eat lean, raw meat, if given to them in small bits.

Water-bugs and insects will become almost as tame as the fish, and even dispute with the latter over a dainty piece of food. One of the most amusing sights is a tiny thread-like eel and a pugnacious whirligig-beetle fighting for the possession of a fly. The eel generally comes off victorious: if he succeeds in once getting a good hold of the fly, he will make a corkscrew or spiral of his body, then commence revolving so rapidly as to often throw the whirligig out of the water.

Remember that aquatic animals, like all other creatures, are very variable in their appetites; some are gluttons, some eat sparingly, some prefer animal food, while others live entirely upon vegetable matter. Carp, dace, and such fish will eat bread; bass, pickerel, and gars will not.

Never allow any food to remain in the bottom of the aquarium to spoil, for it will contaminate the water. The vegetarians in your tank will feed upon the plants growing therein, and they will all eat bread. Most fish will like the prepared food which you can obtain at any aquarium store.

In selecting fish for your aquarium, be careful to have the perch, sun-fish, and bass much smaller than the dace, carp, or gold-fish; otherwise the last-named fish will soon find a resting-place inside the former.

Never put a large frog in an aquarium, for he will devour everything there. A bull-frog that I kept in my studio for

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more than a year swallowed fish, live mice, and brown bats; he also swallowed a frog of nearly his own size; but when he engulfed a young alligator, we were almost as amazed as if he had swallowed himself.

The Frog.

For the benefit of the curious, here is a partial record of Mr. Frog's meals from May until November:

May 14th.—Over a dozen brown beetles.

May 15th.—One full-grown live mouse.

May 19th.—One full-grown spotted frog.

May 24th.—A piece of beef one-third size of the frog himself.

June 2d, 9 A.M.—One live mouse.

June 2d, 1 P.M.—One live mouse.

June 5th.—A piece of steak one-half size of the frog.

July 18th.—One full-grown live mouse.

July 20th.—One young alligator 11 $\frac{1}{4}$ inches long.

This was a pet alligator, and I just came in in time to see the tip of his tail sticking out of the frog's mouth. Taking hold

of the alligator's tail I helped Mr. Frog disgorge my pet, but the saurian was dead.

July 27th.—One full-grown live mouse.

July 29th.—One full-grown live mouse.

August 9th.—One full-grown live mouse.

September 17th.—One large brown bat.

September 20th.—One live craw-fish.

September 21st.—Two live craw-fish.

September 22d.—One live craw-fish.

September 25th, 27th, and October 8th.—Each one full-grown live mouse.

November 15th.—This gluttonous frog ate two-thirds of a white perch and

November 17th.—Died of a fit of indigestion.

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But so celebrated had the frog become on account of his pluck and voracious appetite, that his obituary was published in several papers.

Craw-fish are very mischievous; they pull up the plants, upset the rockery, nip the ends off the fishes' tails, crack the mussel-shells, pull out the inmates and devour them, squeeze the caddice-worm from his little log-house, and, in fact, are incorrigible mischief-makers. But, from that very fact, I always keep one or two small ones. The other inhabitants of the aquarium soon learn to dread the pincer of these fresh-water lobsters, and keep out of the way. Tadpoles are always an interesting addition to an aquarium.

Pickerel and gars should be kept in an aquarium by themselves.

Pond-bass make very intelligent pets. I once had three hundred of these little fellows, perfectly tame. Down in one corner of the cornfield I found two patent washing-machines, the beds of which were shaped like scow-boats. These old machines were fast going to ruin, and I readily gained permission to use them for whatever purpose I wished; so, with a hatchet, I knocked off the legs and top-gear; then removed a side from each box, and fastened the two together, making a tank about four feet square. The seam, or crack, where the two parts joined, was filled with oakum, and the whole outside was thickly daubed with coal-tar. The tank was then set in a hole dug for that purpose, and dirt filled in and packed around the sides. Back of it I piled rocks, and planted ferns in all the cracks and crannies, and also put rocks in the centre of the tank, first covering the bottom with sand and gravel. After filling this with water and plants, three hundred little bass were introduced, and they soon became so tame that they would follow my finger all around, or would jump out of the water for a bit of meat held between the fingers. Almost any wild creatures will

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yield to persistent kind treatment, and become tame. Generally, too, they learn to have a sort of trustful affection for their keepers, who, however, to earn the confidence of such friends, should be almost as wise, punctual, and unfailing as good Dame Nature herself.

Gold-Fish versus Bass.

One of the same bass, which I gave to a friend of mine, lived in an ordinary glass globe for three years. It was a very intelligent fish, but very spiteful and jealous. My friend's mother thought it was lonesome, and so, one day, she brought home a beautiful gold-fish—a little larger than the bass—to

keep it company. She put the gold-fish in the globe, and watched the bass, expecting to see it wonderfully pleased; but the little wretch worked himself into a terrible passion, erected every spine upon his back, glared a moment at the intruder, and then made a dart forward, seized the gold-fish by the abdomen, and shook it as a terrier-dog shakes a rat, until the transparent water was glittering all over with a shower of golden scales. As soon as possible, the carp was rescued; but it was too late. He only gasped and died. The vicious little bass swam around and around his globe, biting in his rage at all the floating scales. Ever after, he was allowed to live a hermit's life, and he behaved himself well. At last the family went away for a couple of weeks, and, when they returned, the poor little bass lay dead at the bottom of his globe.

It might be well to state, before finishing this article, that common putty, after being exposed to the action of water, is very apt to soften and crumble away, or drop off in large flakes. Painting it will not prevent this. In New York, and I suppose other large cities, the aquarium-stores keep a substance which they call aquarium cement. It looks like red putty, but I have found that it withstands the action of water admirably. For

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fifty cents enough can be purchased to cement a large aquarium; but for the benefit of those among my readers who live out of the cities, the following receipt from the *Scientific American* is inserted.

"*Aquarium Cement.*—Linseed oil, 3 oz.; tar, 4 oz.; resin, 1 lb.; melt together over a gentle fire. If too much oil is used the cement will run down the angles of the aquarium; to obviate this it should be tested before using by allowing a small quantity to cool under water; if not found sufficiently firm, allow it to simmer longer or add more tar and resin. The cement should be poured in the corners of the aquarium while warm (not hot). This cement is pliable, and is not poisonous."

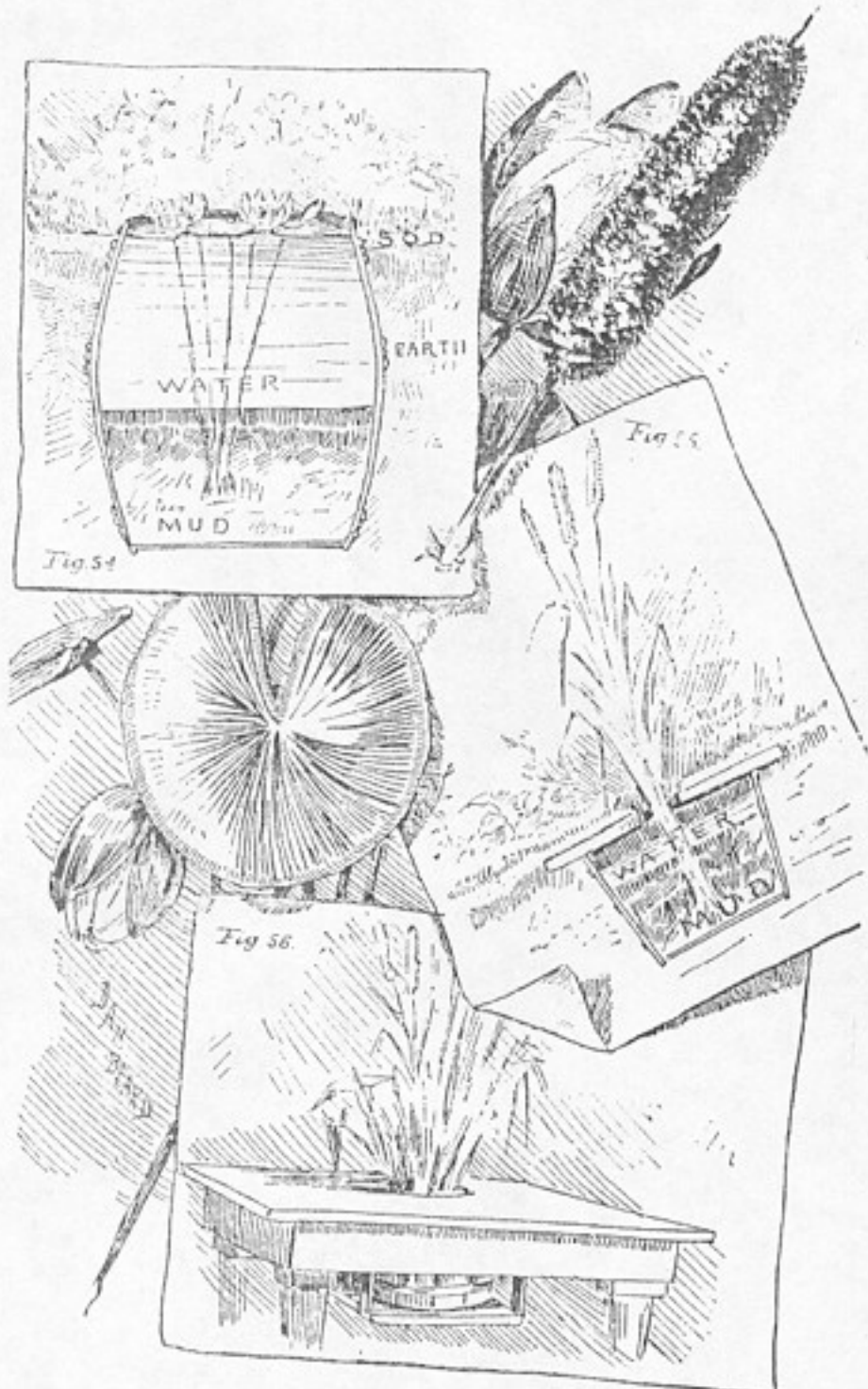


Whirligig and the Eel.

CHAPTER VI.

HOW TO KEEP AQUATIC PLANTS IN THE HOUSE OR FLOWER-GARDEN.

IN gathering plants for your aquarium you will undoubtedly see many much too large for your purpose, and yet so beautiful that you naturally desire to keep them. Some water plants are extremely lovely and all of them odd when seen



growing anywhere but in their accustomed places. Water-lilies growing in the midst of a lawn will be sure to excite surprise, and cat-tails flourishing in a conservatory will be a novelty. Yet it is a comparatively simple matter to rear these and other aquatic plants in your house and garden.

Water-Lily.

Select a spot in your flower-bed and make an excavation of sufficient depth to set a water-tight barrel in, so that the top of the barrel will be even with the surface of the ground. Set the barrel in and fill the earth around. In the bottom of the barrel put about eight or ten inches of black pond-mud; plant the water-lily roots firmly in centre of mud. Fill the barrel with water, being careful to pour it in gradually, so as not to disturb or displace the mud. Figure 54 shows a cross-section of ground and barrel. Everything being then as it is in the natural or wild state, the lily will flourish and bloom, adding a beautiful and curious feature to your plat. Supply fresh water only as the water in the barrel evaporates.

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Cat-Tails.

Cat-tails are of graceful form and make a pretty back-

ground. At the nearest marsh dig up a bunch of good healthy ones and plant them in some of their native mud in a water-tight box or pail. Set the box or pail in the earth. A cover of plank, with a round hole in the centre for the cat-tails to come through, should be put over the top and covered with the sod. Half an inch of water over the surface of the mud in box or pail is all that is necessary. (See illustration, Fig. 55.) Figure 56 shows how cat-tails may be disposed of in-doors, or where it is inconvenient to make room for them in the soil. A very unique and effective floral arrangement may be made by grouping pot-plants around them.

CHAPTER VII.

HOW TO STOCK AND KEEP A MARINE AQUARIUM.

THE first introduction of the aquarium revealed another world and its inhabitants: a world of enchantment, far surpassing any described in the "Arabian Nights" or fairy tales; a world teeming with life so strange that some of it we can scarcely believe to be real.

The marine aquarium has laid bare secrets that have been locked in the breast of the ocean for ages. Through the crystal sides of the tanks are now shown living animals, of forms so lovely and delicate as to remind us of the tracery of frost-work. We can behold in the transparent waters fishes circling about, with distended fins that resemble the gorgeous wings of butterflies; and we can see, glancing here and there, other fish, the glitter of whose glossy sides dazzles us and is as various in hue as the rainbow. The rocks at the bottom are carpeted with animals in the forms of lovely flowers!

The remarks in regard to the form and general construction of fresh-water aquariums will apply equally to marine tanks. The best form for the latter is the shallow vessel with a slanting false bottom, described in a preceding chapter and illustrated by Figures 51 and 52.

If you have a common rectangular tank, such as can be purchased at any aquarium-store (Fig. 50), it may be rendered inhabitable for marine animals by making a few improvements. Four tall glass panels admit too much light; therefore give the

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outside of the glass a coat of green paint on all but one side, leave that clean and transparent to serve as a window, through which may be observed the interior and its occupants. The rockery or arch that is to occupy the centre of the aquarium should be cemented together with marine cement. Although this is not absolutely necessary, it is the best plan, and prevents many accidents. The following receipt I cull from the *Scientific American*:

Cement for Marine Aquaria.—Take 10 parts, by measure, litharge, 10 parts plaster-of-Paris, 10 parts dry white sand, 1 part finely powdered resin, and mix them when wanted for use into a pretty stiff putty with boiled linseed oil. This will stick to wood, stone, metal or glass, and hardens under water. It resists the action of salt water. It is better not to use the tank until three days after it has been cemented.

The arch may be built out of clean cinders or ragged and irregular stones; an old oyster-shell with its rough side uppermost can be used as a top-piece. To make the arch steady and not liable to upset, the bottom should be composed of rather large flat stones.

Cover the bottom of the aquarium to a depth of an inch or more with sand from the beach. Procure the salt water from the ocean itself, and if possible obtain the supply some distance from shore. In no case must you dip the water for your aquarium up from the mouth of a fresh-water stream or muddy creek. If the tank is narrow and deep, fill only about one-third of it. Let the water stand in the aquarium for several days before introducing the plants. Select the bright algæ or seaweeds that you find attached to small pebbles; the stones will of course sink to the bottom of your aquarium and keep the plants in an upright and stationary position. After all is arranged to your satisfaction, choose a place for the location of your tank where there will be light enough to plainly see its contents

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and cause little bubbles of oxygen to collect and rise from the vegetation. A window facing the north or northeast is the best situation. When you observe that the plants are in a thriving condition, and that a new vegetation has apparently sprung spontaneously into existence, carpeting the rockery and sides of the glass with green, then and not until then introduce the animals. Be very careful not to overstock the tank. Remember, no matter how bright and pleasant a room may be with one or two persons in it, the atmosphere of that same room will become foul and heavy in the presence of a large crowd, and if the ventilation be insufficient, headache, dizziness, and death will ensue, as was the case in the terrible Black Hole of Calcutta. Unless you want to make a miniature "black hole" of your aquarium, do not overcrowd it. Let the water have light, but no sunshine. Put a glass cover over the tank to keep out the dust, but let the cover fit loosely enough to allow a free circulation of air. The glass top-piece will in a measure prevent evaporation. If, however, any water is lost from this cause, recollect that the salts contained in sea water do not evaporate, and consequently the tank may be replenished with fresh water equalling the amount evaporated. Beware of the hot summer months. I have always found it more difficult to keep the water pure during July and August than any other part of the year. Do not allow smoking in the room where your aquarium is, as the foul atmosphere taints the water. I once lost almost all the inhabitants of a thriving marine tank, by allowing a party of gentlemen to smoke in the room where it was standing. If you have company in the evening, the room, as a rule, will become overheated, and you should take the precaution to wrap the sides of the tank with wet towels.

The prepared food mentioned in the preceding chapter will answer for some salt-water animals. Lean beef, cut in very small bits, may be dried and kept for feeding marine pets when oysters

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or clams cannot be had. The clams and oysters should be chopped up very fine when used. Anemones and madrepores should be fed in quantities regulated by the size of the animals, and not more frequently than once a week. The food should be placed gently within their reach by means of a pair of forceps or some similar instrument. Crabs will soon learn to come out of their hiding-places at meal-times, and the fish will not be behind time in getting their share of chopped clam. If you have a vivarium (Figs. 51 and 52), a handful of fiddler-crabs may be kept upon your artificial beach, where they will soon make themselves at home and afford a constant source of amusement by their antics. I kept a lot of little "fiddlers" in a fish globe, and for more than a year they lived without salt water, happy and con-

tented with a bit of damp sand to dig in and an occasional piece of chopped oyster to eat. It would be difficult to find odder or more easily satisfied pets than the grotesque little fiddlers. Each male crab has one large claw which for exercise or amusement he keeps in constant motion, only folding it up when preparing to enter his hole or scamper sideways across the sand. The pedunculated eyes of these little creatures stand up in a manner that gives them a very pert appearance.

Remove all dead animals or particles of food not devoured by the inmates, from the aquarium, to prevent the water from becoming tainted with poisonous gases emanating from the decaying animal matter. Dead vegetation, though not as injurious as dead animals, should nevertheless be removed, for it is unsightly, and makes the water turbid and muddy. No matter how foul sea-water may become, you must not waste it, for the injury is never permanent, and can soon be remedied by filtering or exposing it in earthenware vessels to the air and gently stirring it occasionally with a stick or piece of glass.

A filter may be made of a flower-pot, by stopping up the hole in the bottom with a perforated cork in which a small

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quill has been inserted, and then filling the pot half full of powdered charcoal, sand, and gravel—the charcoal at the bottom, the sand next, and the fine gravel or coarse sand on top. This filter when in use should be hung over, but some distance above, an earthen-ware dish, and the water allowed to fall drop by drop, or in a small stream, from the pot to the dish, or the filter may be hung over the aquarium, and each drop of water as it falls will carry with it into the tank below particles of the purifying, life-giving oxygen gathered up on its journey through the air.



Fiddler Crabs.

CHAPTER VIII.

HOW TO COLLECT FOR MARINE AQUARIUM.

NEAR high-water mark, among the sea-weed and drift that have been washed up by a storm, is a veritable curiosity shop, and one well worth inspecting, but most of the animals to be found in this heterogeneous mass of drift, shells, plants, and pieces of wreck are either badly injured or dead, and, though many valuable specimens may here be obtained for the cabinet or museum, it is not a good place to find living, healthy animals for the aquarium.

If you are going on a collecting tour in search of living objects you must go prepared for a good rough-and-tumble time among slippery stones, muddy bottoms, or grimy old docks and piers.

You should wear no clothing that you care to preserve. Salt water will ruin shoes, so put on any old pair that will protect your feet from the shells or sharp stones; if the shoes have holes that let the water in, console yourself with the thought that the water can run out the same way. In fact, you must be prepared for a slip-up in the mud, or a good ducking in the shallow water, where the bottom is often so slippery that it is hard to wade far without involuntarily sitting down once or twice. After you have rigged yourself out in "old togs," next equip yourself with a basket to hold upright some glass preserve-jars or a lot of wide-mouthed bottles; then, armed with a small hammer, an old case-knife or trowel, a dip-net made of coarse bagging or fine mosquito-netting, you are ready for any

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game from a lobster to the minute little crustacean found among the algæ.

You should time your excursion so as to be on the hunting-ground at extreme low tide. As soon as you reach the beach wade right into your work; look under the stones, scoop up the sand or mud with your net from the bottom of all the pools left by the tide, examine every promising-looking bunch of sea-weed, and before the tide comes in you will have material enough to stock forty aquariums. When you reach home sort out your specimens, discard all weak and sickly animals, and put the healthy ones in flat earthenware dishes of salt water, where they may be examined at leisure, and the proper ones taken out and put into your aquarium. In the mud and sand between the tides, or in the shallow water at extreme low tide, live many curious creatures.

If you should discover among the dirt in the bottom of your dip-net some queer-looking tubes, preserve them carefully, for they may contain some of those odd and often brilliantly colored marine worms. The inland boy, who is accustomed to see only the unsightly angle-worm, has no idea what really beautiful creatures some of the marine worms are. See, for instance, there is something in the mud that looks like a drop of blood. Put it in a plate of salt water and watch how one by one it begins to put forth its tentacles until its whole appearance is changed. This is a worm with a long scientific* name, which you may learn by and by if you become interested enough in your recreation to make a study of it.

Do not neglect to collect a few barnacles for your aquarium, and you will find yourself amply repaid for the trouble you found in detaching them from their native posts or rocks, when you see them each put forth an odd hand-shaped member, open-

* *Polycirrus eximius*.

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ing and closing the numerous long, slender fingers as if the animals inside the shells were grasping for something in the water, as, indeed, they are, for it is by this means that the little hermits in their acorn-shaped houses obtain their food.

For collecting in deep water, dredges are used; these are described among the summer sports, page 86.

Summer.



tempts.

A bulky, cumbersome knot is not only ungainly, but is generally insecure.

As a rule, the strength of a knot is in direct proportion to its neat and handsome appearance.

To my mind, it is as necessary that the archer should know how to make the proper loops at the end of his bow-string, as it is that a hunter should understand how to load his gun.

Every fisherman should be able to join two lines neatly and securely, and should know the best and most expeditious method of attaching an extra hook or fly; and any boy who rigs up a hammock or swing with a "granny," or other insecure knot, deserves the ugly tumble and sore bones that are more than liable to result from his ignorance.

A knot, nautically speaking, is a "bend" that is more permanent than a "hitch." A knot properly tied never slips, nor does it jam so that it cannot be readily untied. A "hitch" might be termed a temporary bend, as it is seldom relied upon for permanent service. The "hitch" is so made that it can be cast off, or unfastened, more quickly than a knot.

It is impossible for the brightest boy to learn to make "knots, bends, and hitches" by simply reading over a description of the methods; for, although he may understand them at

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the time, five minutes after reading the article the process will have escaped his memory; but if he take a piece of cord or rope, and sit down with the diagrams in front of him, he will find little difficulty in managing the most complicated knots; and he will not only acquire an accomplishment from which he can derive infinite amusement for himself and a means of entertainment for others, but the knowledge gained may, in case of accident by fire or flood, be the means of saving both life and property.

The accompanying diagrams show a number of useful and important bends, splices, etc. To simplify matters, let us commence with Fig. 57, and go through the diagrams in the order in which they come:

The "English," or "common single fisherman's knot" (Fig. 57, I.), is neat and strong enough for any ordinary strain. The diagram shows the knots before being tightened and drawn together.

When exceptional strength is required it can be obtained by joining the lines in the ordinary single fisherman's knot (Fig. 57, I.), and pulling each of the half knots as tight as possible, then drawing them within an eighth of an inch of each other and wrapping between with fine gut that has been previously softened in water, or with light-colored silk.

An additional line, or a sinker may be attached by tying a knot in the end of the extra line, and inserting it between the parts of the single fisherman's knot before they are drawn together and tightened.

The "fisherman's double half knot," Fig. 57 (II. and III.). After the gut has been passed around the main line and through itself, it is passed around the line once more and through the same loop again, and drawn close.

Fig. 57 (IV., V. and IX.). Here are three methods of joining the ends of two lines together; the diagrams explain them

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much better than words can. Take a piece of string, try each one, and test their relative strength.

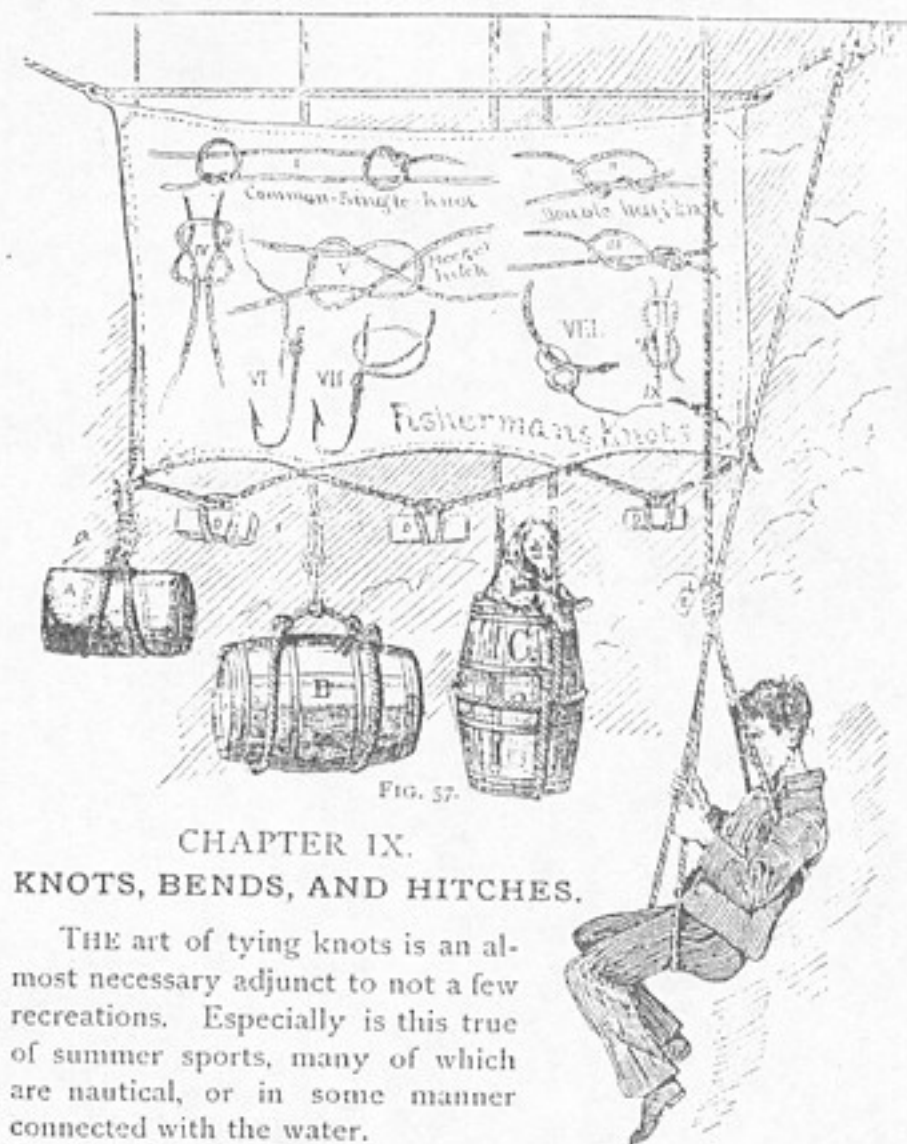


FIG. 57.

CHAPTER IX. KNOTS, BENDS, AND HITCHES.

THE art of tying knots is an almost necessary adjunct to not a few recreations. Especially is this true of summer sports, many of which are nautical, or in some manner connected with the water.

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Any boy who has been aboard a yacht or a sail-boat, must have realized that the safety of the vessel and all aboard may be imperilled by ignorance or negligence in the tying of a knot or fastening of a rope.

With some, the knack of tying a good, strong knot in a heavy rope, or light cord, seems to be a natural gift; it is certainly a very convenient accomplishment, and one that with practice and a little perseverance may be acquired even by those who at first make the most awkward and bungling at-

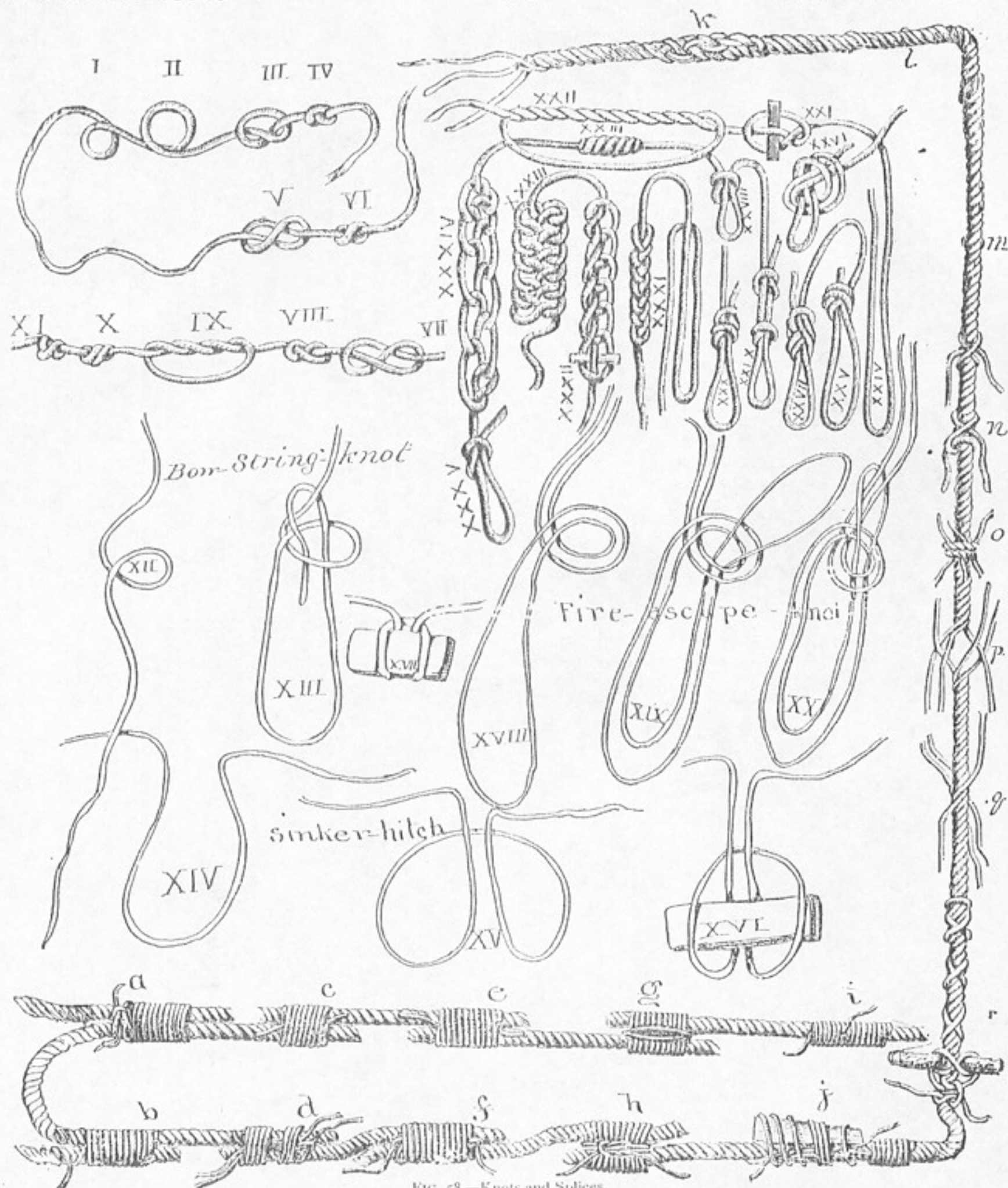


FIG. 58.—Knots and Splices.

Fig. 57 (VI.). It often happens, while fishing, that a hook is caught in a snag, or by some other means lost. The diagram shows the most expeditious manner of attaching another hook by what is known as the "sinker hitch," described further on (Fig. 57, D, D, D, and Fig. 58, XIV., XV., and XVI.).

Fig. 57, VII. is another and more secure method of attaching a hook by knitting the line on with a succession of hitches.

How To Make a Horse-Hair Watch-Guard.

The same hitches are used in the manufacture of horse-hair watch-guards, much in vogue with the boys in some sections of the country. As regularly as "kite-time," "top-time," or "ball-time," comes "horse-hair watch-guard time."

About once a year the rage for making watch-guards used

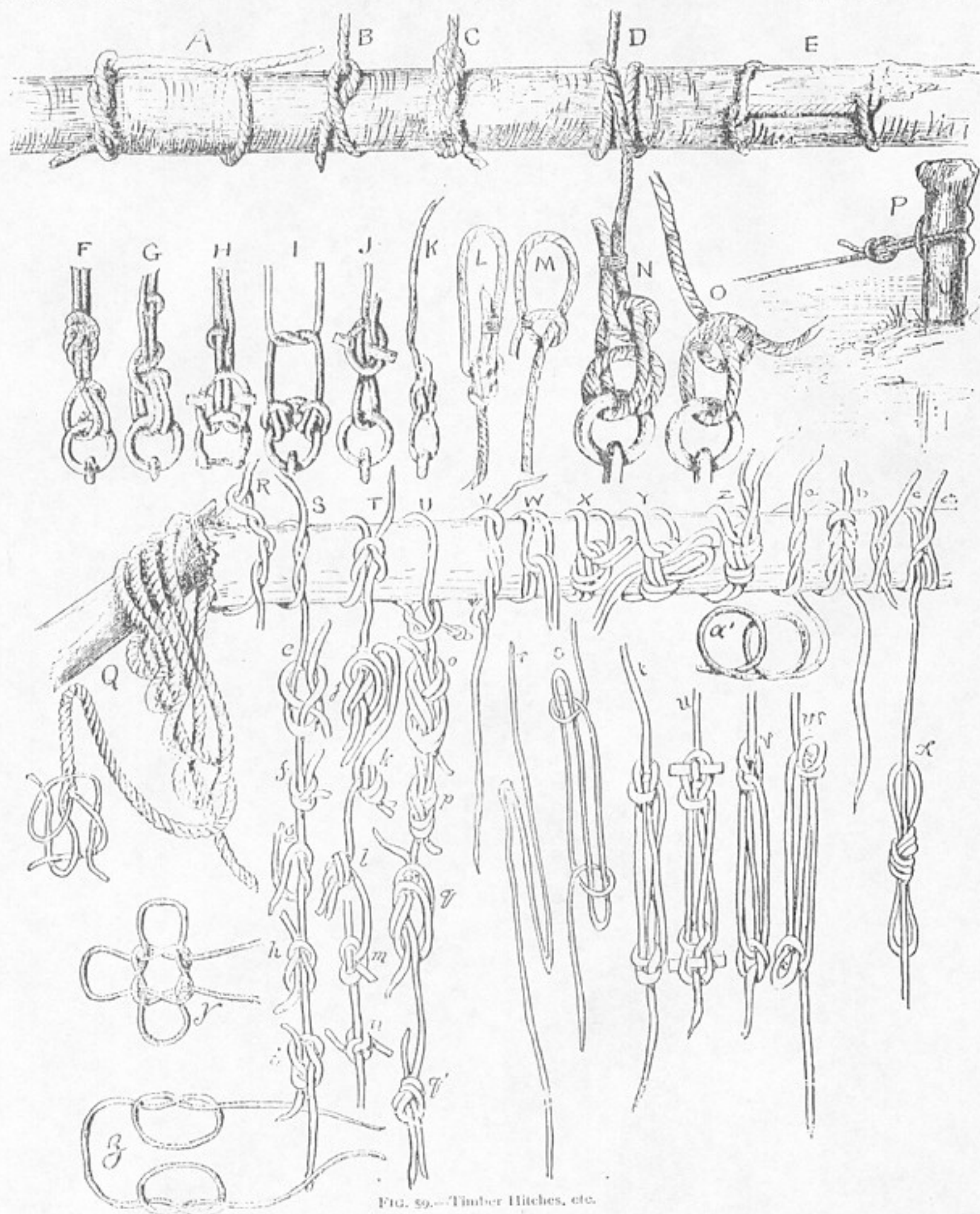


FIG. 59.—Timber Hitches, etc.

to seize the boys of our school, and by some means or other almost every boy would have a supply of horse-hair on hand. With the first tap of the bell for recess, some fifty hands would dive into the mysterious depths of about fifty pockets, and before the bell had stopped ringing about fifty watch-guards, in a more or less incomplete state, would be produced.

Whenever a teamster's unlucky stars caused him to stop near the school-house, a chorus of voices greeted him with "Mister,

please let us have some hair from your horses' tails."

The request was at first seldom refused, possibly because its nature was not at the time properly understood; but lucky was the boy considered who succeeded in pulling a supply of hair from the horses' tails without being interrupted by the heels of the animals or by the teamster, who, when he saw the swarm of boys tugging at his horses' tails, generally repented his first good-natured assent, and with a gruff "Get out, you young rascals!" sent the lads scampering to the school-yard fence.



The Young Collectors.

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Select a lot of long hair of the color desired; make it into a switch about the eighth of an inch thick by tying one end in a simple knot. Pick out a good, long hair and tie it around the switch close to the knotted end; then take the free end of the single hair in your right hand and pass it under the switch on one side, thus forming a loop through which the end of the hair must pass after it is brought up and over from the other side of the switch. Draw the knot tight by pulling the free end of the hair as shown by Fig. 57, VII. Every time this operation is repeated a wrap and a knot is produced. The knots follow each other in a spiral around the switch, giving it a very pretty, ornamented appearance. When one hair is used up select another, and commence knitting with it as you did with the first, being careful to cover and conceal the short end of the first hair, and to make the knots on the second commence where the former stop. A guard made of white horse-hair looks as if it might be composed of spun glass, and produces a very odd and pretty effect. A black one is very genteel in appearance.

Miscellaneous.

Fig. 57, VIII. shows a simple and expeditious manner of attaching a trolling hook to a fish-line.

Fig. 57, F is a hitch used on shipboard, or wherever lines and cables are used. It is called the Blackwall hitch.

Fig. 57, E is a fire-escape made of a double bowline knot, useful as a sling for hoisting persons up or letting them down from any high place; the window of a burning building, for instance. Fig. 58, XVIII., XIX. and XX. show how this knot is made. It is described on page 77.

Fig. 57, A is a "bale hitch," made of a loop of rope. To make it, take a piece of rope that has its two ends joined; lay the rope down and place the bale on it; bring the loop opposite you up, on that side of the bale, and the loop in front up,

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on the side of the bale next to you; thrust the latter loop under and through the first and attach the hoisting rope. The heavier the object to be lifted, the tighter the hitch becomes.

An excellent substitute for a shawl-strap can be made of a cord by using the bale hitch, the loop at the top being a first-rate handle.

Fig. 57, B is called a cask sling, and C (Fig. 57) is called a butt sling. The manner of making these last two and their uses may be seen by referring to the illustration. It will be noticed that a line is attached to the bale hitch in a peculiar manner (a, Fig. 57). This is called the "anchor bend." If while aboard a sail-boat you have occasion to throw a bucket over for water, you will find the anchor bend a very convenient and safe way to attach a line to the bucket handle.

Fig. 58, I. and II. are loops showing the elements of the simplest knots.

Fig. 58, III. is a simple knot commenced.

Fig. 58, IV. shows the simple knot tightened.

Fig. 58, V. and VI. show how the Flemish knot looks when commenced and finished.

Fig. 58, VII. and VIII. show a "rope knot" commenced and finished.

Fig. 58, IX. is a double knot commenced.

Fig. 58, X. is the same completed.

Fig. 58, XI. shows a back view of the double knot.

Fig. 58, XII. is the first loop of a "bowline knot." One end of the line is supposed to be made fast to some object. After the turn or loop (Fig. 58, XII.) is made, hold it in position with your left hand and pass the end of the line up through the loop or turn you have just made, behind and over the line above, then down through the loop again, as shown in the diagram (Fig. 58, XIII.); pull it tight and the knot is complete. The "sinker hitch" is a very handy one to know, and the

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variety of uses it may be put to will be at once suggested by the diagrams.

Lines that have both ends made fast may have weights attached to them by means of the sinker hitch (Fig. 57, D, D, D).

To accomplish this, first gather up some slack and make it in the form of the loop (Fig. 58, XIV.); bend the loop back on itself (Fig. 58, XV.) and slip the weight through the double loop thus formed (Fig. 58, XVI.); draw tight by pulling the two top lines, and the sinker hitch is finished (Fig. 58, XVII.).

The "fire-escape sling" previously mentioned, and illustrated by Fig. 57, E, is made with a double line.

Proceed at first as you would to make a simple bowline knot (Fig. 58, XVIII.).

After you have run the end loop up through the turn (Fig. 58, XIX.), bend it downward and over the bottom loop and turn, then up again until it is in the position shown in Fig. 58, XX.; pull it downward until the knot is tightened, as in Fig. 57, E, and it makes a safe sling in which to lower a person from any height. The longer loop serves for a seat, and the shorter one, coming under the arms, makes a rest for the back.

Fig. 58, XXI. is called a "boat knot," and is made with the aid of a stick. It is an excellent knot for holding weights which may want instant detachment. To detach it, lift the weight slightly and push out the stick, and instantly the knot is untied.

Fig. 58, XXII. Commencement of a "six-fold knot."

Fig. 58, XXIII. Six-fold knot completed by drawing the two ends with equal force. A knot drawn in this manner is said

to be "nipped."

Fig. 58, XXIV. A simple hitch or "double" used in making loop knots.

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Fig. 58, XXV. "Loop knot."

Fig. 58, XXVI. shows how the loop knot is commenced.

Fig. 58, XXVII. is the "Dutch double knot," sometimes called the "Flemish loop."

Fig. 58, XXVIII. shows a common "running knot."

Fig. 58, XXIX. A running knot with a check knot to hold.

Fig. 58, XXX. A running knot checked.

Fig. 58, XXXI. The right hand part of the rope shows how to make the double loop for the "twist knot." The left hand part of the same rope shows a finished twist knot. It is made by taking a half turn on both the right hand and left hand lines of the double loop, and passing the end through the "bight" (loop) so made.

Whip-lashes.

Fig. 58, XXXII. is called the "chain knot," which is often used in braiding leather whip-lashes. To make a "chain knot," fasten one end of the thong or line; make a simple loop and pass it over the left hand; retain hold of the free end with the right hand; with the left hand seize the line above the right hand and draw a loop through the loop already formed; finish the knot by drawing it tight with the left hand. Repeat the operation until the braid is of the required length, then secure it by passing the free end through the last loop.

Fig. 58, XXXIII. shows a double chain knot.

Fig. 58, XXXIV. is a double chain knot pulled out. It shows how the free end is thrust through the last loop.

Fig. 58, XXXV. Knotted loop for end of rope, used to prevent the end of the rope from slipping, and for various other purposes.

Splices, Timber-Hitches, etc.

Although splices may not be as useful to boys as knots and hitches, for the benefit of those among my readers who are

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interested in the subject, I have introduced a few bands and splices on the cables partly surrounding Fig. 58.

Fig. 58, *a* shows the knot and upper side of a "simple band."

Fig. 58, *b* shows under side of the same.

Fig. 58, *c* and *d* show a tie with cross ends. To hold the ends of the cords, a turn is taken under the strands.

Fig. 58, *e* and *f*. Bend with cross strands, one end looped over the other.

Fig. 58, *g* shows the upper side of the "necklace tie."

Fig. 58, *h* shows the under side of the same. The advantage of this tie is that the greater the strain on the cords, the tighter it draws the knot.

Fig. 58, *i* and *j* are slight modifications of *g* and *h*.

Fig. 58, *p* shows the first position of the end of the ropes for making the splice *k*. Untwist the strands and put the ends of two ropes together as close as possible, and place the strands of the one between the strands of the other alternately, so as to interlace, as in *k*. This splice should only be used when there is not time to make the "long splice," as the short one is not very strong.

From *l* to *m* is a long splice, made by underlaying the strands of each of the ropes joined about half the length of the splice, and putting each strand of the one between two of the

other; *q* shows the strands arranged for the long splice.

Fig. 58, *n* is a simple mode of making a hitch on a rope.

Fig. 58, *o* is a "shroud knot."

Fig. 58, *r* shows a very convenient way to make a handle on a rope, and is used upon large ropes when it is necessary for several persons to take hold to pull.

Fig. 59, A. Combination of half hitch and timber hitch.

Fig. 59, B. Ordinary half hitch.

Fig. 59, C. Ordinary timber hitch.

Fig. 59, D. Another timber hitch, called the "clove hitch."

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Fig. 59, E. "Hammock hitch," used for binding bales of goods or cloth.

Fig. 59, F. "Lark-head knot," used by sailors and boatmen for mooring their crafts.

Fig. 59, P shows a lark-head fastening to a running knot.

Fig. 59, G is a double-looped lark-head.

Fig. 59, H shows a double-looped lark-head knot fastened to the ring of a boat.

Fig. 59, I is a "treble lark-head." To make it you must first tie a single lark-head, then divide the two heads and use each singly, as shown in the diagram.

Fig. 59, J shows a simple boat knot with one turn.

Fig. 59, K. "Crossed running knot." It is a strong and handy tie, not as difficult to make as appears to be.

Fig. 59, L. is the bowline knot, described by the diagrams XII. and XIII. (Fig. 58). The free end of the knot is made fast by birding it to the "bight" or the loop. It makes a secure sling for a man to sit in at his work among the rigging.

Fig. 59, M, N, and O. "Slip clinches," or "sailors' knots."

Fig. 59, Q shows a rope fastened by the chain hitch. The knot at the left-hand end explains a simple way to prevent a rope from unravelling.

Fig. 59, R. A timber hitch; when tightened the line binds around the timber so that it will not slip.

Fig. 59, S. Commencement of simple lashing knot.

Fig. 59, T. Simple lashing knot finished.

Fig. 59, U. "Infallible loop;" not properly a timber hitch, but useful in a variety of ways, and well adapted for use in archery.

Fig. 59, V. Same as R, reversed. It looks like it might give way under a heavy strain, but it will not.

Fig. 59, W. Running knot with two ends.

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Fig. 59, X. Running knot with a check knot that can only be opened with a marline-spike.

Fig. 59, Y. A two-ended running knot with a check to the running loops. This knot can be untied by drawing both ends of the cord.

Fig. 59, Z. Running knot with two ends, fixed by a double Flemish knot. When you wish to encircle a timber with this tie, pass the ends, on which the check knot is to be, through the cords before they are drawn tight. This will require considerable practice.

Fig. 59, *a* shows an ordinary twist knot.

Fig. 59, *a'* shows the form of loop for builder's knot.

Fig. 59, *b*. Double twist knot.

Fig. 59, *c*. Builder's knot finished.

Fig. 59, *d* represents a double builder's knot.

Fig. 59, *e*. "Weaver's knot," same as described under the

head of Becket hitch (Fig. 57, V).

Fig. 59, *f*. Weaver's knot drawn tight.

Fig. 59, *g* shows how to commence a reef knot. This is useful for small ropes; with ropes unequal in size the knot is likely to draw out of shape, as *m*.

Fig. 59, *h* shows a reef knot completed.

Of all knots, avoid the "granny;" it is next to useless under a strain, and marks the tier as a "landlubber."

Fig. 59, *i* shows a granny knot; *n* shows a granny under strain.

Fig. 59, *j* shows the commencement of a common "rough knot."

Fig. 59, *k*. The front view of finished knot.

Fig. 59, *l*. The back view of finished knot. Although this knot will not untie nor slip, the rope is likely to part at one side if the strain is great. Awkward as it looks, this tie is very useful at times on account of the rapidity with which it can be made.

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Fig. 59, *o* and *p*. Knot commenced and finished, used for the same purposes as the Flemish knot.

Fig. 59, *q* and *q'*. An ordinary knot with the ends used separately.

Fig. 59, *s*. Sheep-shank, or dog-shank as it is sometimes called, is very useful in shortening a line. Suppose, for instance, a swing is much longer than necessary, and you wish to shorten it without climbing aloft to do so; it can be done with a sheep-shank.

Fig. 59, *r* shows the first position of the two loops. Take two half hitches, and you have a bend of the form shown by *s*. Pull tightly from above and below the shank, and you will find that the rope is shortened securely enough for ordinary strain.

Fig. 59, *t*. Shortening by loop and turns made where the end of the rope is free.

Fig. 59, *u*. A shortened knot that can be used when either end is free.

Fig. 59, *v*, *w*, and *x*. Shortening knots.

Fig. 59, *y* and *z*. A "true lover's knot," and the last one that you need to practise on, for one of these knots is as much as most persons can attend to, and ought to last a lifetime.



CHAPTER X.

THE WATER-TELESCOPE.

NEARLY three-fourths of the whole world is covered by water. Old Isaak Walton in his quaint book says that this vast expanse of territory is "Nature's storehouse, in which she locks up all her wonders." The previous chapters on fresh water and marine aquariums have already shown how a portion of the "wonders" may be kept in your own house, in what might be termed little glass side-shows to the great marine menagerie. This chapter will tell you how to make an in-

strument through which you can peep under the watery tent of the big show itself, and see the curiosities swimming about in their native haunts.

The water-telescope is not made of aqueous fluid, as its name might imply, but is a contrivance made of wood or metal, through which, when one end is partly submerged, objects beneath the water can be plainly seen that would otherwise be invisible.

It is astonishing how many fathoms of water become almost as transparent as air when viewed through one of these simple and amusing contrivances. In Norway, the fishermen make practical use of the water telescope when searching for herring shoals or cod, often by its means discovering new and unlooked-for fish.

How to Make a Wooden Water-Telescope.

All that is necessary is a long wooden box, a piece of glass for one end, and some paint and putty for making the seams

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water-tight. Fix the glass in one end of the box, and leave the other end open to admit the eyes of the observer, as shown in the illustration (Fig. 60).



FIG. 60.—Wooden Water-Telescope.

A Tin Water-Telescope,

is a funnel-shaped tin horn, about three or four feet long, eight to ten inches in diameter at the bottom, and broad enough at the top to admit both eyes of the observer (Fig. 61). Sinkers should be soldered on near the bottom, as shown in the illustration (Fig. 61). This in a measure counteracts the buoyancy of

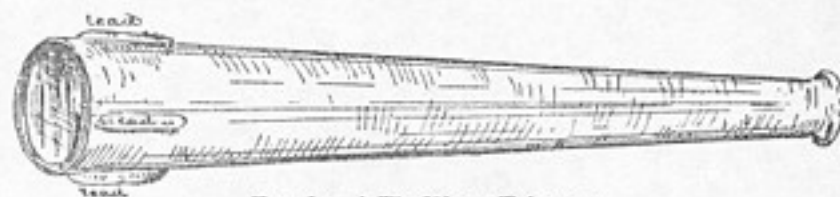


FIG. 61.—A Tin Water-Telescope.

the air contained in the water-tight funnel, and helps to submerge the big end.

The inside of the funnel should be painted black, to prevent the light from being reflected upon the bright surface of the tin.

If any difficulty is found in procuring a circular piece of glass, the bottom may be made square and square glass used, and fitted into a leaden frame made for the purpose.

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Any tinner can, at a moderate cost, make an instrument like the one just described.

A water-telescope will add greatly to the entertainment of a boating party or picnic, furnishing a new and novel feature that will become popular wherever it is introduced.

Mr. Fred. Holder tells me that while collecting marine animals with his father, Dr. Holder, the naturalist, they had a boat built with a glass in the hull, arranged and worked upon the

same principle as a water-telescope. It was of great service where the water was not too deep. While one person rowed the other watched the bottom, which Mr. Holder describes as having the appearance of a beautiful panorama passing beneath him. Fish of all colors and forms filled the intervening space, and sometimes a "devil fish" would cross the scene, flapping its great wing like fins as it flew rather than swam through the clear water.



CHAPTER XI.

DREDGE, TANGLE. AND TRAWL FISHING.

A New Sport.

THIS new pastime not only insures the fisherman something to show for his day's work, but, by furnishing an incentive, it lends an additional charm to rowing or sailing, and combines the pleasures of fishing and boating, perhaps, in a greater degree than any other sport upon the list of out-door exercises. There is no good reason why the "dredge" and "tangle" should be monopolized by a few learned scientists, nor why the sport should not be indulged in by all boys, as well as men, who love the open air, the salt sea breeze, Nature and her wonders.

To put this new pastime within the reach of the boys, this chapter illustrates and describes the "regular" dredge made

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upon the most improved pattern, and it also shows how serviceable dredges and tangles may be made out of simple materials to be found about any house.

The dredge is an instrument made to drag along the bottom of the water and scoop up the objects, such as corals, sponges, etc., that are found there.

The common oyster dredge is a familiar object at all sea-side places, but it has two or three defects which make it objectionable to the amateur dredger. In the first place, it requires a skilled hand to keep it right side up when in use. Nothing is more discouraging to a beginner than to discover, after a long pull, that on account of the dredge being towed upside down the scraper has been unable to perform its duty. The meshes of an oyster dredge are made very large purposely, that all small objects may slip through. Among these small objects are some of the curiosities most prized by the collector.

To remedy the first defect, the collector's dredge is made with a scraper upon both sides (Fig. 65). The second defect is

overcome by using a net with very fine meshes.

The net, if unprotected, would soon be cut and torn into shreds by the sharp-edged shells or rough bottom. To prevent this, it is enclosed in a leather or canvas bag open at both ends (Fig. 65). The dotted line shows the net inside.

The handles and scrapers are composed of iron.

If the machine become fast between the rocks of the bottom, the string that binds the joint marked in the diagram (Fig. 65) will part, thus allowing the machine to turn edgewise and free itself.

Many curious objects were frequently brought up clinging to the cable or the frayed edges of the canvas cover of the dredges first used, and it was noticed that the dredge itself seldom contained any of these objects. This fact gave birth to

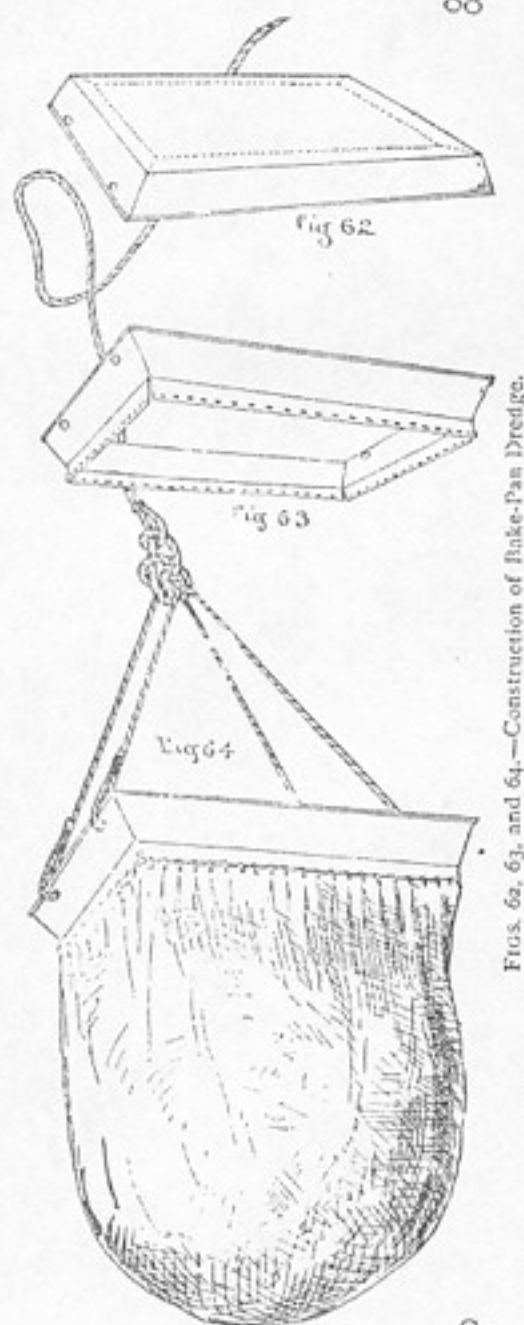
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The Tangle,

a name given to tassels of hemp that are often attached to the bottom of the dredge itself or used separately (Figs. 66 and 67).

The Trawl.

If the bottom to be explored be smooth a trawl can be used (Fig. 68). This consists of a net larger than the one connected with the dredge. The front of the net is attached to a rod at the top and hangs slack at the bottom, being weighted by small sinkers. The rod is fastened to runners which allow the trawl to slide smoothly over the bottom. Weights are sometimes fastened to the ends of the runners. It is a good idea to have pockets in the net, to prevent the fish from escaping. The end of the net should be gathered and tied with a string, so that by untying



FIGS. 62, 63, and 64.—Construction of Bake-Pan Dredge.

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the string the contents can be dumped out in less time than it takes to tell of it.

How to Make a Bake-Pan Dredge.

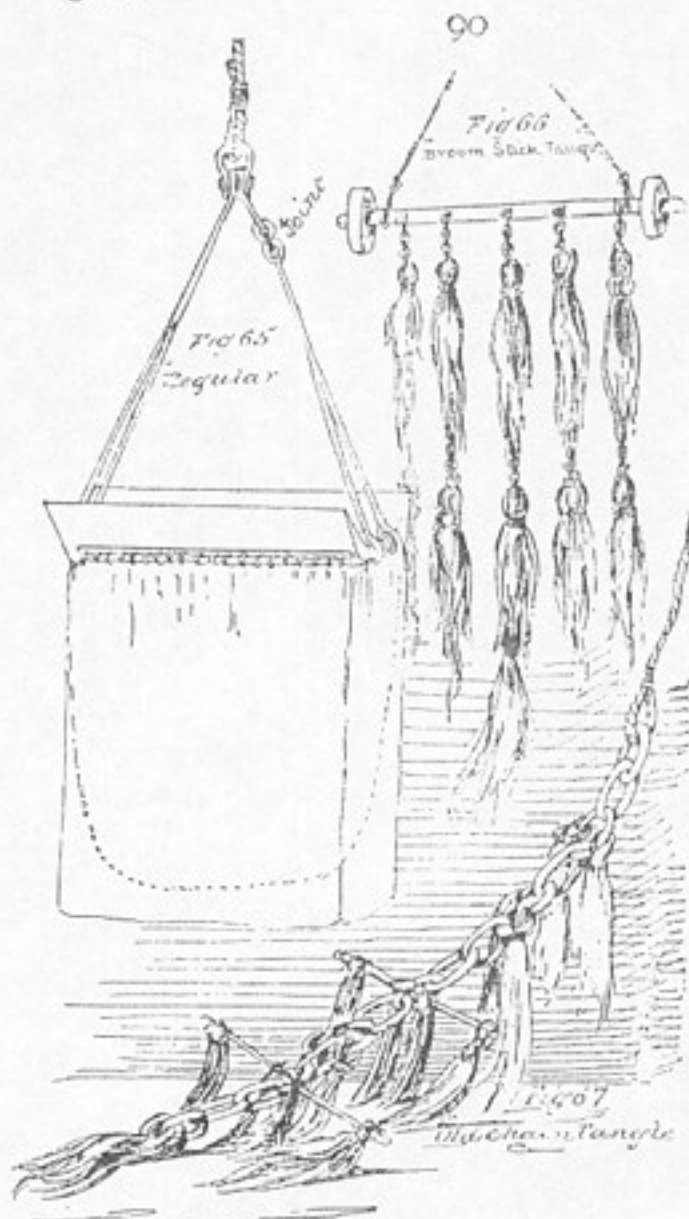
There is a sort of flat sheet-iron pan used in the kitchen for holding bread or biscuit while baking. It is seldom that the cook cannot show you one of these pans (Fig. 62) that has served its time and been discarded. Such a one will make a first-rate frame for a dredge. The only difficulty will be found in cutting the bottom out neatly. If there be a tin shop in the

neighborhood it is best to take the pan there and have the tinner cut it for you; or you may do it yourself with a can opener or some other convenient instrument. Cut as shown by the dotted lines in Fig. 62, which represents the pan bottom upwards. This will leave a margin of about an inch and a half still adhering to the pan; with a strong nail and a hammer punch holes all around the marginal piece of the bottom. Make two larger holes in each end to admit the ropes forming the handles.

Bend the bottom pieces out as illustrated by Fig. 63, and it will produce a compact and handy frame for a small dredge.

An old coffee sack can be readily adapted so as to serve as a net, but if the canvas cover be used as in Fig. 65, mosquito netting of double thickness will answer for the inner pouch.

Fig. 64 shows a "bake-pan dredge" with ropes attached ready for use. Although the framework of a "regular" dredge can be made by any blacksmith at trifling cost, it is more fun to make a dredge for one's self. When once the principles upon which a machine is made are thoroughly understood, it requires but little ingenuity to produce home-made substitutes that will perhaps answer as well, if not better, than the originals.



FIGS. 65, 66, and 67.—Regular-made Dredge, Broomstick and Old Chain Tangle.

A Tin-Pail Dredge.

Take any old tin bucket, knock the bottom out, and attach a piece of coffee sack for a net. Tie bunches of hemp to the rim, first punching holes for the purpose, and you will have a make-shift dredge like the one in the tail-piece that only requires a few minutes to manufacture. Even with such a crude apparatus as this, many things may be captured for the cabinet or aquarium, the

How to Make a Broomstick Tangle.

Saw off from an old broom handle a piece of stick about two and one-half feet long; hunt up three or four pieces of chain about the size used for large dog-chains; with small iron staples fasten these chains at intervals along the broomstick. Tie bunches of hemp securely along the chains. If you have no hemp, unravel pieces of old rope ends and tie them to the chains as in the illustration (Fig. 66). The broomstick, being light, will possibly float in spite of the chains. This can only be prevented by attaching weights to the stick.

If a couple of iron wheels can be procured and put upon the ends of the broomstick they will not only counteract the buoyancy of the stick, but will also, in a measure, prevent the tangle from fouling stones or other objects on the bottom.

In the place of the iron wheels, simple weights of lead or other material may be used, and instead of the chains, weighted strings can be tied to the stick and the hempen knots fastened to them. Still another tangle can be made of a piece of old chain.

The Old Chain Tangle,

as may be seen by the illustration (Fig. 67), is simply a piece of iron chain decorated with hempen tassels and occasional cross-sticks. A rope is attached to one end, and by its means the tangle is hauled over the bottom to gather up its load of curiosities.

Hints and Suggestions to Amateurs.

If dredging from a sail-boat, divide the crew into two parties, one to manage and sail the boat, the other to attend to the

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casting and hauling of the dredge. It is as necessary that the boat be carefully managed as it is that at least one person's undivided attention be given to handling the dredge. The dredging rope should be about twice as long as the water is deep. A wooden reel or windlass attached to one side of the boat near the stern will be of very great assistance, especially when the net comes up filled with mud or heavy stones, as it frequently does; in which case, if there be but one boy to attend to it he will find it no light task to pull in the line hand over hand.

A piece of old oilcloth or tarpaulin will answer to dump the contents of the dredge upon, although a large wooden tray, or "picking-over board," as it is called, is much better. A small board of the kind intended for a row-boat is shown in the illustration at the head of this chapter.

Common glass preserve jars, or wide-mouthed bottles, make excellent receptacles for living specimens. A convenient rack for carrying these easily and safely may be made from any wooden box, by nailing laths or slats across the top from end to end and side to side, making the squares thus formed just large enough to hold the jars or bottles in an upright position.

The sail-boat is best for long excursions, but for a short trip a row-boat is preferable, it being more readily handled and independent of the wind.

Although a dredge without tangles will bring up many curious and interesting objects, the specimens are apt to be confined to the mollusca or shell-fish, mixed, of course, with all manner of rubbish.

If properly managed, the pouch, when it reaches the surface, will be about half full. After it has been emptied upon the "picking-over" board, the mud and sand may be washed away by pouring water over the mass. Although not absolutely neces-

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hempen tangles serving not only to entangle star-fish, sea-urchins, and the like, but in a measure preventing other creatures that have been scooped up by the pail from making their escape.

sary, a large sieve is a desirable addition to the dredger's outfit, and furnishes valuable assistance when the mud or sand is to be

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searched for minute objects. Some dredgers use a "nest of sieves," so arranged that the strainers, four in number, fit freely within one another. The top sieve is of course smaller than the others, but the meshes are larger. The second sieve is a little larger, with finer meshes. The third is still larger, with a much finer mesh, and the fourth, the largest sieve of the lot, has a mesh so close as only to allow the finest sand or mud to pass through. The contents of a dredge when filtered through a "nest of sieves" is divided up into a graduated series, the largest objects at the top and the smallest at the bottom. Mr. Emerton, in his "Life on the Seashore," describes a sieve for hanging over the side of a boat "in the shape of a half cylinder," the bottom being made of strong wire; but, as before remarked, sieves are not absolutely necessary, and may be dispensed with when the object is only : day's fun with the curiosities of the sea.

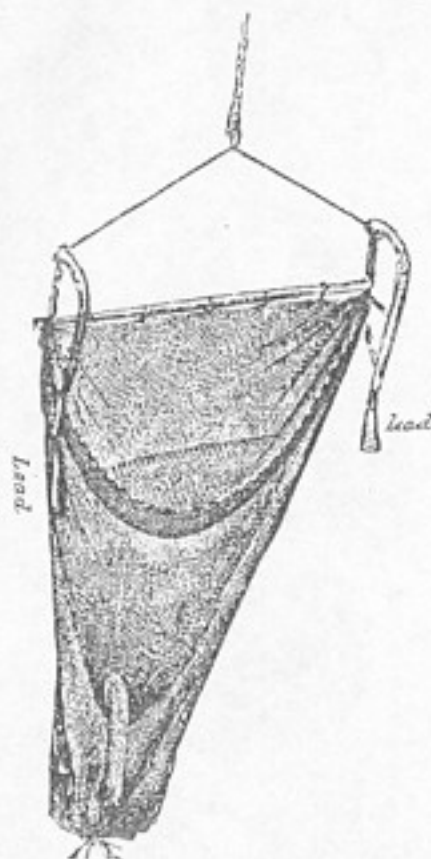


FIG. 68.—The Trawl.

The Use of the Tangle.

Partially buried in the mud of the bottom are to be found many pretty corals, queer and curious sponges, and those funny animals called sea-cucumbers. The dredge may skip these, but the hempen tangles, when they sweep the bottom, catch all

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such rough or irregular objects and bring them to the surface, along with a miscellaneous assortment of star-fish, sea-urchins, crabs, shrimps, and hundreds of other creatures.

Wyville Thompson, in his interesting account of the dredging cruise of the Porcupine and Lightning, mentions one haul when the tangles contained not fewer than 20,000 sea-urchins, which "were warped through and through the hempen fibres and actually filled the tangles; and," adds Mr. Thompson, "they hung for days round the bulwarks like nets of pickling onions in a green-grocer's shop." At times the tangle, when it comes to the surface, is completely covered with curious little shrimp-like creatures called Caprellas. Indeed, so many surprises await the dredger and tend to keep up the excitement, that this new



Tin-Pail Dredge.

sport cannot fail to interest and delight all who participate in it; and when the young dredgers return home they need not do so empty-handed, but may, if they choose, bring curiosities from the bottom of the sea that will not only astonish their parents, but most likely puzzle their teachers and professors.

Under the head of TAXIDERMY, among the autumn sports, will be found some hints which will aid the reader in preserving marine specimens for the cabinet or for future study.

CHAPTER XII.

HOME-MADE BOATS.

Birth of the "Man-Friday" Catamaran.—The Crusoe Raft.

NOT so very many years ago I remember visiting, in company with my cousin Tom, a small lake at the head waters of the Miami. High and precipitous cliffs surround the little body of water. So steep were the great weather-beaten rocks that it was only where the stream came tumbling down past an old mill that an accessible path then existed. Down that path Tom and I scrambled, for we knew that large bass lurked in the deep, black holes among the rocks.

We had no jointed split bamboo rods nor fancy tackle, but the fish there in those days were not particular and seldom hesitated to bite at an angle-worm or grasshopper, though the hook upon which the bait squirmed was suspended by a coarse line from a freshly cut hickory sapling.

Even now I feel the thrill of excitement and expectancy as, in imagination, my pole is bent nearly double by the frantic struggles of those "gamy" black bass. After spending the morning fishing we built a fire upon a short stretch of sandy beach, and cleaning our fish and washing them in the spring close at hand, we put them among the embers to cook.

While the fire was getting our dinner ready for us we threw off our clothes and plunged into the cool waters of the lake. Inexpert swimmers as we were at that time, the opposite shore, though apparently only a stone's-throw distant, was too far off

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for us to reach by swimming. Many a longing and curious glance we cast toward it, however, and strong was the temptation that beset us to try the unknown depths intervening. A pair of brown ears appeared above the ferns near the water's edge, and a fox peeped at us; squirrels ran about the fallen trunks of trees or scampered up the rocks as saucily as though they understood that we could not swim well enough to reach their side of the lake; and high up the face of the cliff was a dark spot which we almost knew to be the entrance to some mysterious cavern.

How we longed for a boat! But not even a raft nor a dug-out could be seen anywhere upon the glassy surface of the water or along its reedy border. We nevertheless determined to explore the lake next day, even if we should have to paddle astride of a log.

The first rays of the morning sun had not reached the dark waters before my companion and I were hard at work, with axe and hatchet, chopping in twain a long log we had discovered near the mill. We had at first intended to build a raft; but gradually we evolved a sort of catamaran. The two pieces of log we sharpened at the ends for the bow; then we rolled the logs down upon the beach, and, while I went into the thicket to

chop down some saplings, my companion borrowed an auger from the miller. We next placed the logs about three feet apart, and marking the points where we intended to put the cross-pieces, we cut notches there; then we placed the saplings across, fitting them into these notches. To hold them securely we bored holes down through the sapling cross-pieces into the logs; with the hatchet we hammered wooden pegs into these holes. For the seat we used the half of a section of log, the flat side fitting into places cut for that purpose. All that remained to be done now was to make a seat in the stern and a pair of rowlocks. At a proper distance from the oarsman's seat we

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bored two holes for a couple of forked sticks, which answered admirably for rowlocks; across the stern we fastened another piece of log, similar to that used for the oarsman's seat. With the help of a man from the mill our craft was launched; and



The Man-Friday.

with a pair of oars made of old pine boards we rowed off, leaving the miller waving his hat.

Our catamaran was not so light as a row-boat, but it floated, and we could propel it with the oars, and, best of all, it was our own invention and made with our own hands. We called it a "Man-Friday," and by its means we explored every nook in the length and breadth of the lake; and ever afterward when we wanted a boat we knew a simple and inexpensive way to make one—and a safe one, too.

The Crusoe Raft,

is another rustic craft, but it is of more ambitious dimensions than the "Man-Friday." Instead of being able to float only one or two passengers, the "Crusoe," if properly built, ought to accommodate a considerable party of raftsmen. Of course the purpose for which the raft is to be used, and the number of

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the crew that is expected to man it, must be taken into consideration when deciding upon the dimensions of the proposed craft.

All the tools that are necessary for the construction of a good stout raft are an axe, an auger, and a hatchet, with some strong boys to wield them.

The building material can be gathered upon any wooded bank of lake or stream.

For a moderate sized raft collect six or seven logs, the longest not being over sixteen feet in length, nor more than a

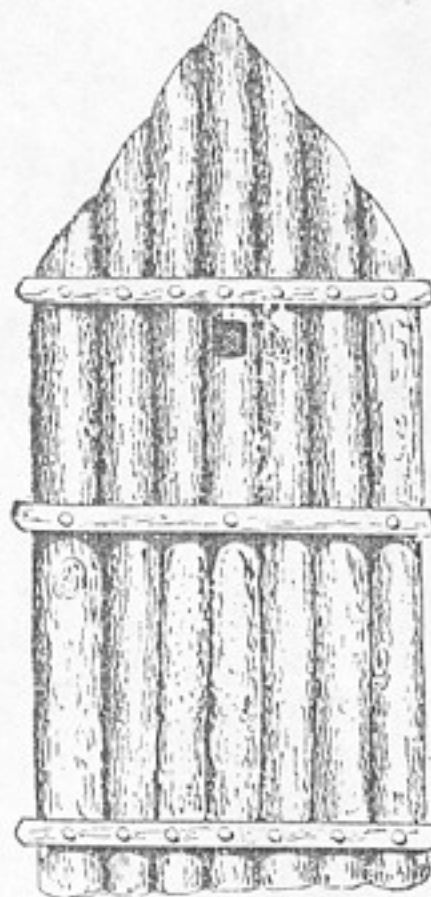


FIG. 69.—Plan of Crusoe Raft.

foot in diameter; the logs must be tolerably straight. Pick out the longest and biggest for the centre; sharpen one end; roll the log into the water and there secure it.

Select two logs as nearly alike as possible, to lie one at each side of the centre log. Measure the centre log, and make the point of each side log, not at its own centre, but at that side of it which will lie against the middle log, so that this side-point shall terminate where the pointing of the middle log begins. (See Fig. 69.)

After all the logs needed have been trimmed and sharpened in the manner just described, roll them into the water and arrange them in order (Fig. 69). Fasten them together with

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"cross-strips," boring holes through the strips to correspond with holes bored into the logs lying beneath, and through these holes drive wooden pegs. The water will cause the pegs to swell, and they will hold much more firmly than iron nails.

The skeleton of the cabin can be made of saplings; such as are used for hoop-poles are the best.

These are each bent into an arch, and the ends are thrust into holes bored for that purpose. Over this hooping a piece of canvas is stretched, after the manner of old-fashioned country wagons (Figs. 70 and 71).

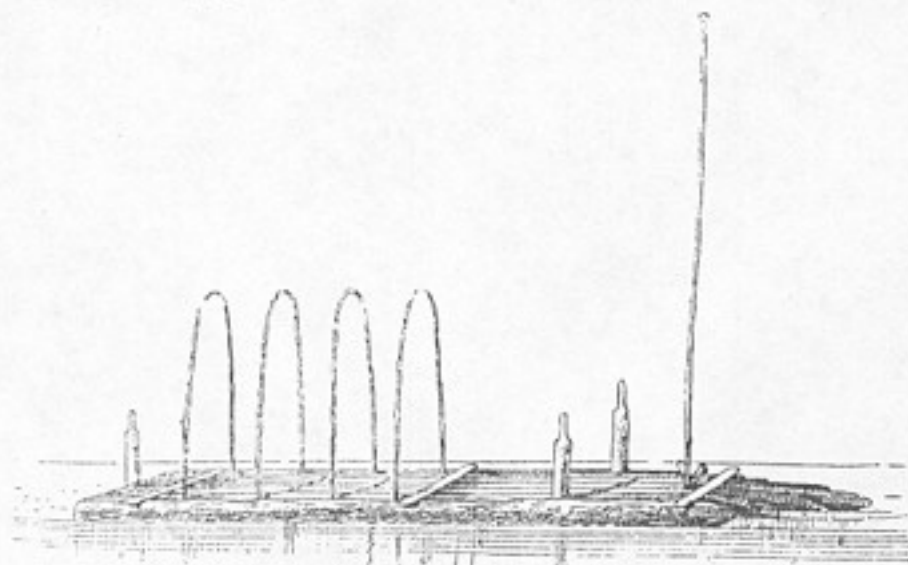


FIG. 70.—Skeleton of Crusoe Raft.

Erect a "jack-staff," to be used as a flag-pole or a mast to rig a square sail on.

A stout stick should be erected at the stern, and a similar one upon each side of the raft near the bow; these sticks, when

their ends are made smaller, as shown in the illustration (Fig. 70), serve as rowlocks.

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For oars use "sweeps"—long poles, each with a piece of board for a blade fastened at one end (Fig. 72).

Holes must be bored through the poles of the sweeps about

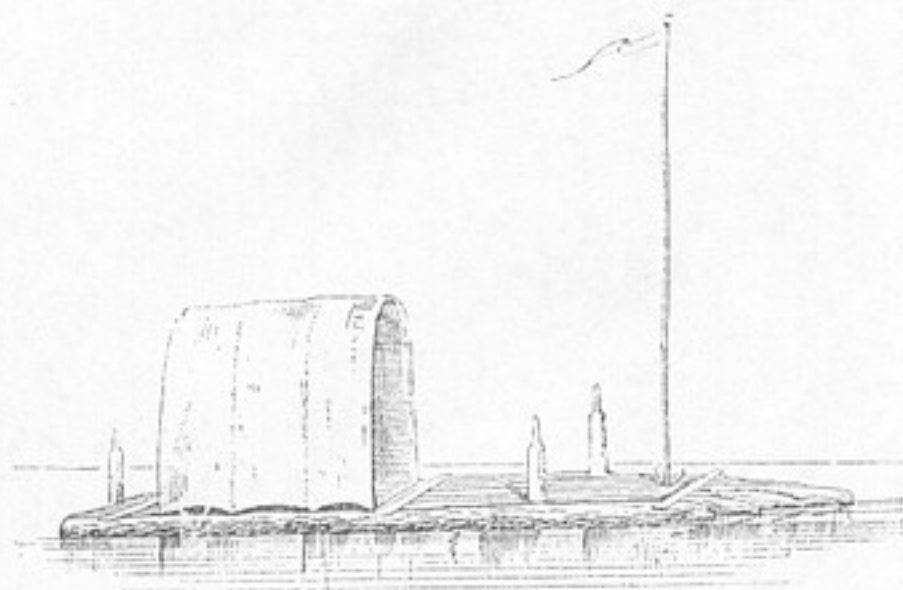


FIG. 71.—Crusoe with Cabin Covered.

three feet from the handle, to slip over the pegs used as rowlocks, as described above. These pegs should be high enough to allow the oarsman to stand while using the sweeps.

A flat stone placed at the bow will serve as a fireplace.

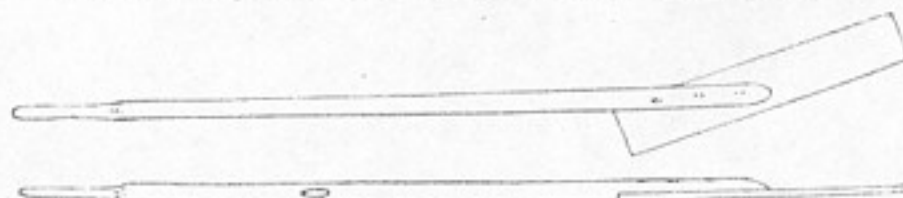


FIG. 72.—Sweeps.

If the cracks between the logs under the cabin are filled up to prevent the water splashing through, and the cabin is floored

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with cross-sticks, a most comfortable bed at night can be made of hay by heaping it under the canvas cover in sufficient quantities.

The "Crusoe" raft has this great advantage over all boats: you may take a long trip down the river, allowing the current to bear you along, using the sweeps only to assist the man at the helm (rear sweep); then, after your excursion is finished, you can abandon the raft and return by steamboat or cars.

The Scow.

There can be but few boys who are not familiar with that large and useful tribe of flat-bottomed, perpendicular-sided boats called "scows." These crafts are used as coal barges, lighters, flat-boats, sail-boats, and row-boats; but it is only to the construction of the last named class that this chapter will be devoted.

To build a scow-shaped row-boat is not a difficult feat, even for a boy; and when it is finished he will find it to be a very convenient boat, roomy, and not hard to row.

The material necessary consists of eight or ten three-quarter-inch pine boards, one one-inch board, some fivepenny nails, and about a half pound of wrought-iron nails of the same size as the ones just mentioned.

A saw, a plane, and a sharp hatchet are requisite in the way

of tools. Other tools, if not absolutely necessary, should not on that account be ignored, as they may come in very handy at times.

When selecting the lumber for the boat, pick out those pieces which are free from large knots and other blemishes. Reserve two of the best boards for the sides, and let them measure 11 feet in length and 12 inches in width when trimmed. Measuring toward the centre, mark a point $2\frac{1}{2}$ feet from each end of one of the side boards upon the edge selected for

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the bottom. Measuring from the bottom edge toward the top, mark a point upon each end 8 inches from the bottom. Saw off the triangular pieces between these points (Fig. 73). Round off the angles with a plane, and make the other side board an exact duplicate of the one just described (Fig. 74).



FIG. 73.—Side Board.

For the ends of the boat use the $1\frac{1}{2}$ -inch plank, making of it two small boards to fit between the ends of the side boards.

The side pieces now measure 4 inches upon each end (Fig. 73), hence the end boards ought to be 4 inches wide; but to make sure of neat joints, it is best to allow $\frac{1}{2}$ inch extra. Make the end pieces 3 feet long, $4\frac{1}{2}$ inches wide, and 1 inch thick. Set the side pieces parallel to each other upon their straight or top edges, and between their ends fit the end boards (Fig. 74). After seeing that all the corners are square, nail the end boards in place. Plane off the protruding edges at the bow and stern, so that the bottom pieces overlapping them will make close joints; then nail the bottom boards on crosswise, as



FIG. 74.

shown in the illustration (Fig. 75). All nails must be driven in so that their heads are below the surface of the board, or as carpenters call it, countersunk, and the indentations made should be puttied up.

Turn the scow over, and upon the inside, at the middle of the

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board; repeat the operation on the other side, using wrought nails and clinching them. If thole-pins are intended to be used,

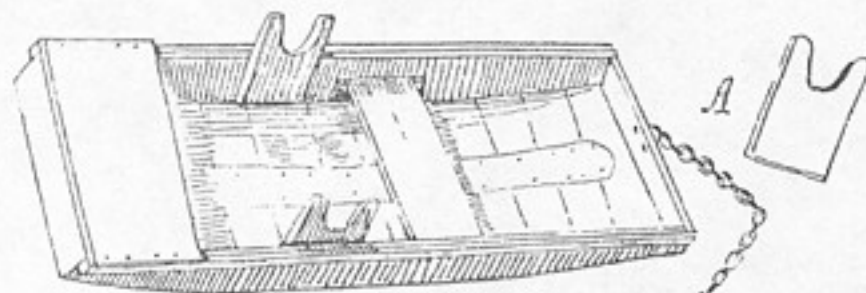


FIG. 75.

before nailing the strips upon the sides, 4 feet 9 inches from one end of each strip cut a notch in the side $\frac{1}{2}$ inch deep and $1\frac{1}{2}$ wide; 3 inches from this notch, or 5 feet from the same end, cut another similar notch. When these strips are nailed on bottom, nail a $\frac{3}{4}$ -inch long bottom board (Figs. 76 and 77). Next cut two small boards of $\frac{3}{4}$ -inch plank; make them 7 inches

wide and about 1 foot 5 inches long; cut out a place in one end of each, as shown by A, Fig. 76; these are to serve as row-



FIG. 75.

locks, and should be nailed with wrought-iron nails to the inside of the boat, so that the centres of the rowlocks are about 4 feet 10 inches from the end which will be the stern of the boat; this is the simplest style of rowlock, but a much neater one can be made by using thole-pins (Fig. 77, B).

Turn the boat upon its side and nail a strip 11 feet long, 2 inches wide, and 1 inch thick upon the upper edge of the side

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the sides (Fig. 77) the notches cut in them form the rowlocks. Put in more nails near the rowlocks than elsewhere, to help to withstand the greater strain that that part has to bear. The end of the boat nearest the rowlocks is the stern. Of oak or some hard wood make four thole-pins to fit into the rowlocks (Fig. 77, B).

For a seat use a board about 1 foot wide; it should be 3 feet long to fit inside the boat; the seat rests upon two cleats

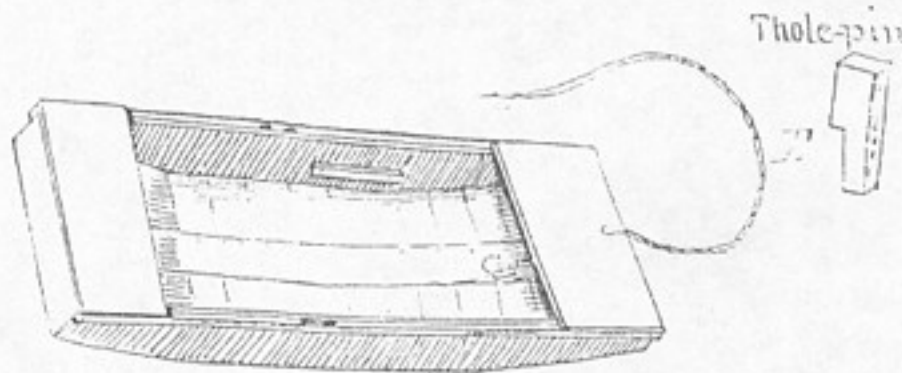


FIG. 77.

set 6 inches below the top of the side boards (Fig. 77); the aft edge of the seat should be about 1 foot forward of the rowlocks.

A bow and stern seat should be made for passengers; these seats need not set so low as the one occupied by the oarsman, and may be made of boards nailed across the top of the boat at the bow and stern, and the space underneath them may be used for lockers.

If a chain "painter" is used, fasten it to the bow with an iron staple (Fig. 76); but if a rope is preferred, or is more easily obtained, run one end of it through a hole bored for the purpose in the bow seat, and knot the end so that it cannot slip out (Fig. 77). When such a boat is built with clean, close-

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fitting joints, and the cracks daubed with thick paint, it is often unnecessary to do any further caulking. A good method is to saturate pieces of woollen cloth with paint and place them between the different parts before they are joined. After the carpenter work is done, go to the paint shop and get a can of white paint, first telling the painter to weigh the can. After you have used what paint is necessary, return the can, have it weighed, and pay only for the amount used. If you are well known the painter will not hesitate to allow you to do this, and you will find it the most economical way. After the first coat of paint is dry put on a second coat; as soon as that is hard-

ened, which will be in two or three days, according to the weather, your boat is ready for launching; it may leak at first, but after the seams have swelled it will be almost perfectly dry inside.

A Floating Camp, or the Boy's Own Flat-Boat.

Flat-boats are essentially inland craft, having their origin with the birth of trade in the West before the puffing and panting steam-boats plowed their way through the turbid waters of Western rivers. They are craft that can be used on any stream large enough to float a yawl, but the St. John's River, Florida, is perhaps the most tempting stream for the amateur flat-boatman. The numerous inlets and lakes connected with the river, the luxuriant semi-tropical foliage on the banks, the strange-looking fish and great, stupid alligators, the beautiful white herons and hundreds of water-fowl of many descriptions—all form features that add interest to its navigation and inducements to hunters, fishermen, naturalists, and pleasure-seekers scarcely equalled by any other accessible river of the United States.

To build the hull of the flat-boat, use pine lumber. For the sides select two good, straight 2-inch planks, 14 feet long

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and about 16 inches wide. Take one of the planks (Fig. 78), measure 6 inches from the top upon each end, and mark the points A, a (Fig. 78); then upon the bottom measure from each end toward the centre 2 feet, and mark the points B, b (Fig. 78). Saw off the corners A, B and a, b, and round the

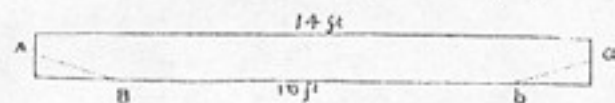


FIG. 78.

angles in the manner described on page 102 and illustrated by Fig. 74. Next take two 2-inch planks, 6½ inches wide and 6 feet long, for the stem and stern; set the side pieces on edge upside down, and nail on the two end pieces (see Fig. 79). Then, allowing 4 inches—the thickness of the two sides—there will be a space inside the boat of 5 feet 8 inches. Take three pieces of scantling about 3 inches thick and 5 feet 8 inches long; place one near the end flush with the bottom of the boat just where the sheer of bow and stern begins (see A and B, Fig. 79). After fitting them carefully, nail them firmly. Nail the other piece of scantling in place at the point C (Fig. 79), so

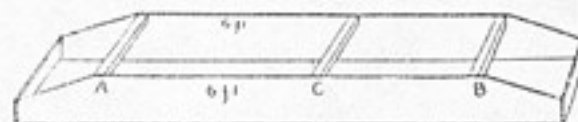


FIG. 79.

that it will measure 6 feet from the outside of the brace A to the outside of the brace C. Plane off the protruding edges of the bow and stern.

A bottom may now be put on as described on page 102 and illustrated by Fig. 75, or a regular flat-boat bottom can be made by selecting good, straight ½-inch lumber a little over 14 feet long, to allow for the curve.

Nail an end of one of the bottom boards to the stern board (see Fig. 80); its side edge must be flush with the outer edge of the side piece. Bend the bottom board carefully along the curve to the first cross piece A (Fig. 80) and nail it firmly; nail it again at C and at the bow, being careful to make it conform to the curve of the sides. Follow the same plan with the

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next board, keeping it close up against the first board so as to



FIG. 80.

leave no crack when the bottom is finished. Caulk up any accidental cracks with oakum; give the whole hull a coating of coal tar, and allow it to harden. The remainder of the work is comparatively easy.

After the coal tar has hardened, turn the boat over and erect four posts, one at each end of the cross piece A and one at each end of the cross piece C (Fig. 79 or 80).

The tops of the posts for this size boat should be about $3\frac{1}{2}$ feet above the bottom of the hull. Put a cross piece on the top of the post at A and another at C, and the framework of your cabin is done. It may now be covered with canvas, or, as in the illustrations, with thin planks, in which case make the roof of $\frac{1}{4}$ -inch boards, bending them in an arch so that the middle will rise about one foot higher than the sides.

The eaves should overhang about six inches beyond the cabin upon each side.

Board up the sides with the same material used for the roofing, leaving openings for windows and doors. Pieces of shoe leather make very good hinges for the door, but iron hinges are of course the best. The cabin can then be floored, a bunk

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or two may be built, and as many other conveniences as your taste or necessities may indicate, can be provided; a few clothes-hooks, etc.

Put in rowlocks; those used in the Crusoe raft are best for large flat-boats, but for this one make rowlocks on the same plan as the ones illustrated by Fig. 76, A (page 103). There should be three rowlocks, one for the steering oar and two near the front for rowing (see Fig. 81).

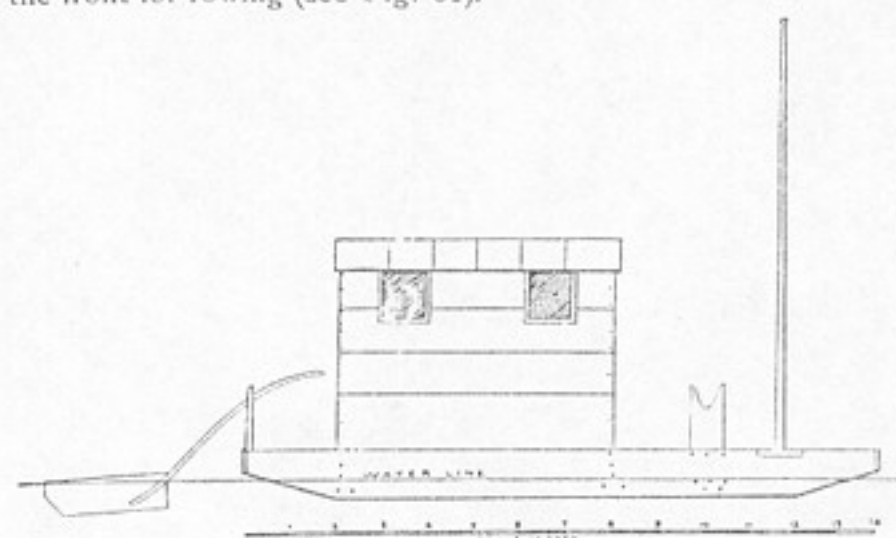


FIG. 81.—Side View of Flat-Boat.

Set a seat in front of the rowlock with a hole in it for the "jack-staff" to pass through. The jack-staff should be made so that it can be taken out and put in at pleasure. This can be done by making a simple socket underneath the seat for the end of the staff to fit in.

The flat-boat is now ready to be launched, which should be done with appropriate ceremonies. Fig. 81 shows the side view of a 14-foot flat-boat; the cabin, to better show its construction, is increased in height in the drawing, and, according

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to the scale, it measures about five feet at the sides and six feet at the ridge-pole. Fig. 82 shows a front view of the same.

Fig. 83 shows a top view of a flat-boat as it would appear looking down upon the roof of the cabin.

The large diagram (Fig. 84) drawn in perspective shows how a cabin for a little larger boat can be arranged. The diagram is drawn on the scale of feet marked below it. The floor is about six feet long by six feet wide, and the side walls are five feet high. A cabin of these dimensions can be arranged with four folding berths, two upon each side, made of boards each two feet wide and fastened to the sides by hinges. The top berths may be supported by their hinges and a cross beam upon the inside, and by two broad

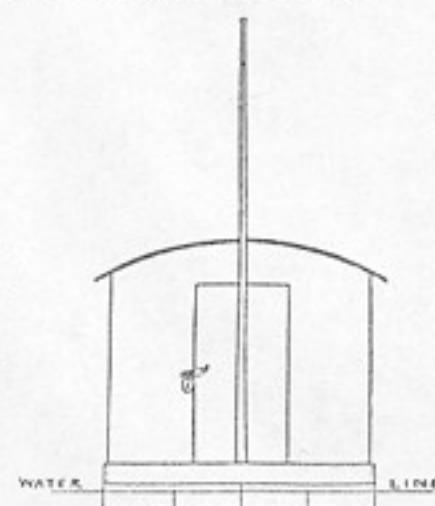


FIG. 82.—Front View of Flat-Boat.



FIG. 83.—Top View of Flat-Boat.

straps upon the outside; the straps button on to knobs in the ends of the berths. The lower berths can be provided with

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folding legs, as shown by the illustration (Fig. 84), which shows two berths down on the left-hand side and two folded up on the right-hand side. The lockers underneath the bottom berths can be used for storing away bed-clothes.

In the rear, under a looking-glass, can be seen a device for a folding desk, which is simply a square board attached to

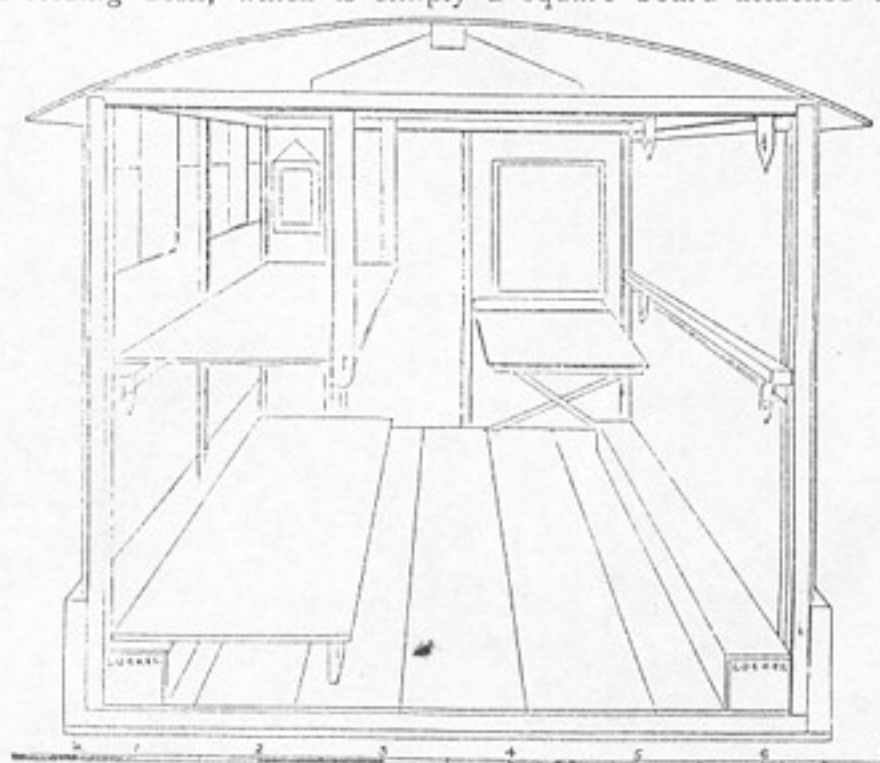


FIG. 84.—Perspective View of Interior of a Cabin.

the wall, like the berths, by hinges, and which may be let down so as to hang flat against the wall, out of the way when the berths are to be used. The legs to the desk are hinged at the bottom, and as the desk is raised the legs fall forward, resting against the cleat upon the bottom of the top
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board, which holds it in the position shown by the diagram. Many other little conveniences may be added, such as a small cooking-stove, book-shelves, gun-racks, etc., but I shall not go into further details, my aim being only to suggest how it may be done, as every boy who is smart enough to build a flat-boat will have his own peculiar ideas about the manner in which it should be fitted up inside. The interior construction depends, in a measure, upon the number of persons who are to occupy the cabin, and whether it is to be used by a party of young naturalists upon a collecting tour, or for fishing and shooting excursions, or simply as a sort of picnic boat for a few days' enjoyment, such as most boys in the country are quite well able to plan and carry out unaided.

Although a rude home-made flat-boat does not possess speed, yet with a square sail rigged on the jack-staff, and with a good wind over the stern, it will make good time; and as this sort of craft draws only a few inches of water, it can float in creeks and inlets where a well-loaded row-boat would drag bottom.

The advantages of a flat-boat consist in the fact that it is a comfortable, cosy little house in which one could spend a month very pleasantly hunting or fishing, or visiting the various points of interest along the shores of the river and inlets, and, whenever the floating home drifts in sight of a pleasant place to stop, all that is necessary is to make fast to the bank, thus escaping the nuisance of moving bag and baggage.

During a cruise the members of the party will have frequent occasion to put in practice all manner of devices for saving labor, and making the hunter as far as possible independent of a mate when, as often happens, two boys cannot be spared from the boat to go foraging together. One of these "wrinkles," as they are termed, is a floating fish-car, adapted for minnows or large fish, which being fastened to the fisherman's
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waist, floats behind as he wades. This arrangement not only saves much weariness in carrying funny spoils to camp after, perhaps, a long and trying day, but it helps to keep the fish fresh; and when not in active use it may be towed behind "The Ark."

Many hints of this same kind might be given, but this one will suffice to show that a boy with his wits about him can lighten very materially the fatigues inseparable from camping out and flat-boating. Endurance of hardship is noble in itself, and there is call enough for it in this rough-and-tumble world; but the fellow who most enjoys "roughing it" in a trip outdoors is he who is quickest to save himself unnecessary exertion by using the simplest means at hand.

The Yankee Pine.

From the saw-mills away up among the tributaries of the Ohio River come floating down to the towns along the shore great rafts of pine lumber. These rafts are always objects of interest to the boys, for the youngsters know that when moored to the shore the solidly packed planks make a splendid platform to

swim from. Fine springing-boards can be made of the projecting blades of the gigantic sweeps which are used to guide the mammoth rafts, and, somewhere aboard, there is always to be found a "Yankee Pine." Just when or why this style of skiff was dubbed with such a peculiar name I am unable to state; but this I know, that when a raft is to be broken up and carted
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A New Wrinkle.

away to the lumber yards there is, or always used to be, a good, light skiff to be had cheap.

However, all boys do not live on the bank of the river, and if they did there would hardly be "Yankee Pines" enough to go round; so we will at once proceed to see how to build one for ourselves. Although my readers may find the "Yankee Pine" a little more difficult to build than the blunt-ended, flat-bottomed scow, it really is a comparatively simple piece of work for boys familiar with the use of carpenters' tools.

For the side pieces select two straight-grained pine boards free from knots. These boards should be about 13 or 14 feet long,
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a couple of inches over a foot in width, and as nearly alike as possible in texture. Besides these, there should be in the neighborhood of a dozen other $\frac{3}{4}$ -inch planks, an inch or two over a half foot in width. A small piece of 2-inch plank for

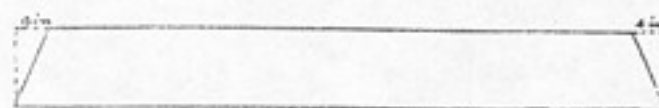


FIG. 85.

the stern piece is also necessary. Upon the bottom edge of the side board measure off from each end toward the centre 4 inches, mark the points, and saw off the corners shown by the dotted line in Fig. 85. Next take a piece of board 4 feet long and a foot wide, saw off the corners as you did on the side

board, making it 4 feet on the top and 3 feet 4 inches on the bottom. This board is to be used only as a centre brace while modelling the boat.

Out of the 2-inch plank make a stern piece of the same shape as the centre brace; let it be 1 foot wide, 14 inches long on the bottom, and 20 inches long on top. Set the side boards on their shorter or bottom edges, and place the centre brace in the middle, as shown by Fig. 86; nail the side boards to it, using

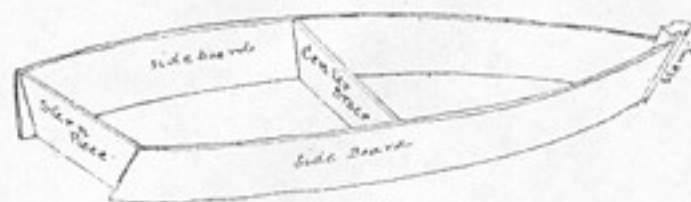


FIG. 86.

only enough nails to hold temporarily. Draw the side boards together at the bow, and against the stern board at the stern (Fig. 86). Hold the side pieces in position by the means of ropes. A stem should be ready to fix in the bow (Fig. 87).

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This had better be a few inches longer than the sides are broad, as it is a simple matter to saw off the top after it is fitted. Make the stem of a triangular piece of timber, by planing off the front edge until a flat surface about $\frac{1}{2}$ inch broad is obtained; 2 inches from the front, upon each side, cut a groove just the thickness of the side boards ($\frac{3}{4}$ inch). Trim the stem so that the side pieces at the bow fit the grooves snugly, and nail the side boards to the stem and to the stern piece (Fig. 86).

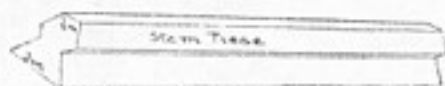


FIG. 87.

Turn the boat upside down, and it will be discovered that the outlines of the bottom form an arch from stem to stern. If left in this shape the boat will sink too deep amidships. Remedy the defect by planing the bottom edge of both side pieces, reducing the convex form to straight lines in the middle. This will allow the bow and stern to sheer, but at the same time will make the central part of the bottom flat, and by having less to drag through the water make it easier to row. Nail the bottom boards on crosswise, and as, on account of the form of the boat, no two boards will be of the same size, they must be first nailed on and the projecting ends sawed off afterward. The centre brace may now be taken out and a long bottom board nailed to the centre of the bottom upon the inside of the boat (Fig. 88). Cut a small cross piece (B, Fig. 88) so that it will fit across the bow 3 inches below the top of the side boards. Nail it in place, driving the nails from the outside of the side-board through and into the end of the stick B. Saw out a bow seat, and, allowing the broad end to rest on the cross stick B, fit the seat in and secure it with nails (Fig. 88); 3 inches below the top of the stern piece nail a cleat across. At the same distance below the side board put a cross stick similar to the one in the bow. This and the cleat on the stern piece form rests

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for the stern seat. Five feet from the stern, saw a notch 2 inches deep and $1\frac{1}{2}$ inch long in each side board (A, A', Fig. 88). Saw two more notches of the same size 3 inches from the first; these will make the rowlock when the side strips have been fastened on.

These strips should each be made of 1-inch plank, 2 inches wide and an inch or two longer than the side boards. Nail the

strips on the outside of the boat flush with the top of the side boards, making a neat joint at the stern piece, as shown in the illustration (Fig. 88). Cut two short strips to fit upon the inside

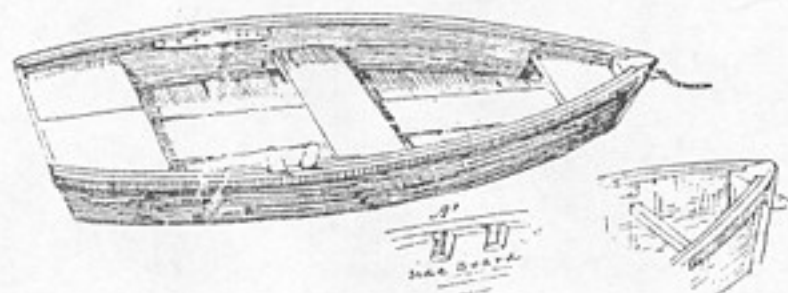


FIG. 88.

at the rowlocks, and fasten them firmly on with screws (Fig. 88, A). Next cut two cleats for the oarsman's seat to rest upon. Nail them to the side boards amidship a little nearer the bottom than the top, so that the seat, when resting upon the cleats, will be about half the distance from the top edge to the bottom of the side boards. Let the aft end of the cleats be about 6 feet 2 inches from the stern. Make thole-pins of some hard wood to fit in the rowlocks, like those heretofore described and illustrated by Fig. 77, B, page 104.

The Yankee Pine now only needs a keel board to complete it. This must be placed exactly in the centre, and is fastened on by a couple of screws at the thin end and nails from the in-

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side of the boat. It is also fastened to the upright stick at the stern by screws (Fig. 89).

If the joints have been carefully made, your Yankee Pine is now ready for launching. Being made of rough lumber it needs no paint or varnish, but is a sort of rough-and-ready affair, light to row; and it ought to float four people with ease. By using planed pine or cedar lumber, and with hard-wood stem and stern, a very pretty row-boat can be made upon the same plan as a Yankee Pine, or by putting in a centre-board and "stepping" a mast in the bow, the Yankee Pine can be transformed into a sail-boat. But before experimenting in this line of boat building, the beginner had better read the following chapter on how to rig and sail small boats.

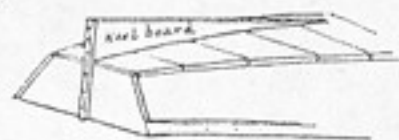
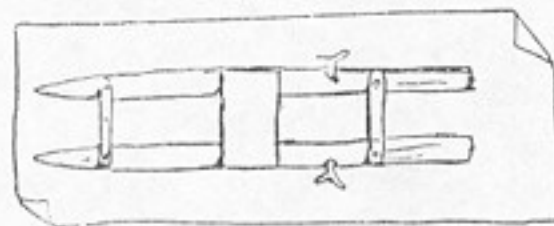


FIG. 89.



Top View of "Man Friday."

CHAPTER XIII.

HOW TO RIG AND SAIL SMALL BOATS.

To have the tiller in one's own hands and feel competent, under all ordinary circumstances, to bring a boat safely into

port, gives the same zest and excitement to a sail (only in a far greater degree) than the handling of the whip and reins over a lively trotter does to a drive.

Knowing and feeling this, it was my intention to devote a couple of chapters to telling how to sail a boat; but through the kind courtesy of the editor of *The American Canoeist*, I am able to do much better by giving my readers a talk on this subject by one whose theoretical knowledge and practical experience renders him pre-eminently fit to give reliable advice and counsel. The following is what Mr. Charles Ledyard Norton, editor of the above-mentioned journal, says:

"Very many persons seem to ignore the fact that a boy who knows how to manage a gun is, upon the whole, less likely to be shot than one who is a bungler through ignorance, or that a good swimmer is less likely to be drowned than a poor one. Such, however, is the truth beyond question. If a skilled sportsman is now and then shot, or an expert swimmer drowned, the fault is not apt to be his own, and if the one who is really to blame had received proper training, it is not likely that the accident would have occurred at all. The same argument holds good with regard to the management of boats, and the author is confident that he merits the thanks of mothers,

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whether he receives them or not, for giving their boys a few hints as to practical rigging and sailing.

"In general, there are three ways of learning how to sail boats. First, from the light of nature, which is a poor way; second, from books, which is better; and third, from another fellow who knows how, which is best of all. I will try to make this article as much like the other fellow and as little bookish as possible.

"Of course, what I shall say in these few paragraphs will be of small use to those who live within reach of the sea or some big lake, and have always been used to boats; but there are thousands and thousands of boys and men who never saw the sea, nor even set eyes on a sail, and who have not the least idea how to make the wind take them where they want to go. I once knew some young men from the interior who went down to the sea-side and hired a boat, with the idea that they had nothing to do but hoist the sail and be blown wherever they listed. The result was that they performed a remarkable set of manœuvres within sight of the boat-house, and at last went helplessly out to sea and had to be sent after and brought back, when they were well laughed at for their performances, and had reason to consider themselves lucky for having gotten off so cheaply.

"The general principles of sailing are as simple as the national game of 'one ole cat.' That is to say, if the wind always blew moderately and steadily, it would be as easy and as safe to sail a boat as it is to drive a steady old family horse of good and regular habits. The fact, however, is that winds and currents are variable in their moods, and as capable of unexpected freaks as the most fiery of unbroken colts; but when properly watched and humored they are tractable and fascinating playmates and servants.

"Now, let us come right down to first principles. Take a bit of pine board, sharpen it at one end, set up a mast about a quarter of the length of the whole piece from the bow, fit on a square piece of stiff paper or card for a sail, and you are ready for action. Put this in the water, with the sail set squarely across (A, Fig. 90), and she will run off before the wind—which

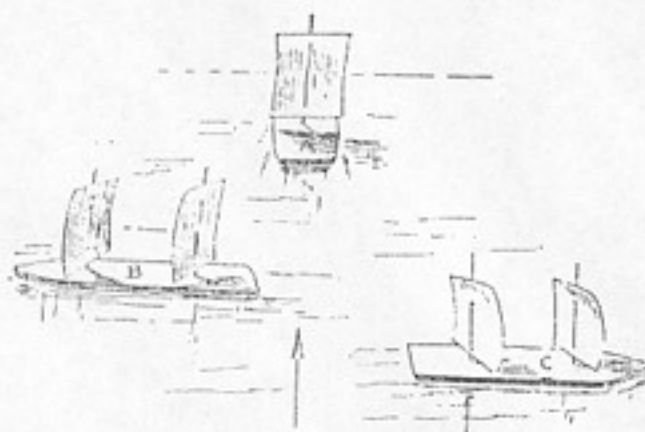


FIG. 90.

"Probably the first primeval man who was born with nautical instincts discovered this fact, and, using a bush for a sail, greatly astonished his fellow primevals by winning some prehistoric regatta. But that was all he could do. He was as helpless as a balloonist is in mid-air. He could go, but he could not get back, and we may be sure that ages passed away before the possibility of sailing to windward was discovered.

"Now, put up, or 'step,' another mast and sail like the first, about as far from the stern as the first is from the bow. Turn the two sails at an angle of forty-five degrees across the boat (B or C, Fig. 90), and set her adrift. She will make considerable progress across the course of the wind, although she will at the same time drift with it. If she wholly refuses to go in the

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right direction, place a light weight on her bow, so that she will be a little 'down by the head,' or move the aftermost mast and sail a little nearer to the stern.

"The little rude affair thus used for experiment will not actually make any progress to windward, because she is so light that she moves sidewise almost as easily as she does forward. With a larger, deeper boat, and with sails which can be set at any angle, the effect will be different. So long as the wind presses against the after side of the sail, the boat will move through the water in the direction of the least resistance, which is forward. A square sail, having the mast in the middle, was easiest to begin with for purposes of explanation; but now we will change to a 'fore-and-aft' rig—that is, one with the mast at the forward edge or 'luff' of the sail, as in Fig. 91. Suppose the sail to be set at the angle shown, and the wind blowing as the arrow points. The boat cannot readily move sidewise, because of the broadside resistance; she does not move backward, because the wind is pressing on the aftermost side of the sail. So she very naturally moves forward. When she nears buoy No. 1, the helmsman moves the 'tiller,' or handle of the rudder, toward the sail. This causes the boat to turn her head toward buoy No. 2, the sail swings across to the other side of the boat and fills on that side, which now in turn becomes the aftermost, and she moves toward buoy No. 2 nearly at right angles to her former course. Thus, through a series of zig-zags, the wind is made to work against itself. This operation is called 'tacking,' or

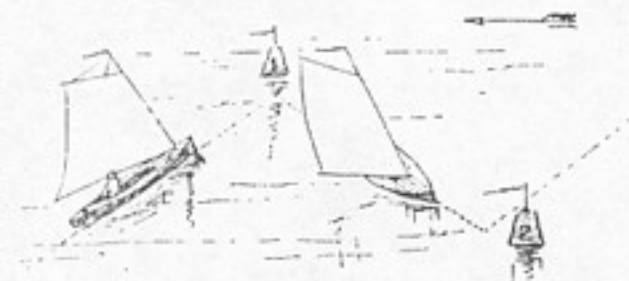


FIG. 91.

"The little rude affair thus used for experiment will not actually make any progress to windward, because she is so light that she moves sidewise almost as easily as she does forward. With a larger, deeper boat, and with sails which can be set at any angle, the effect will be different. So long as the wind presses against the after side of the sail, the boat will move through the water in the direction of the least resistance, which is forward. A square sail, having the mast in the middle, was easiest to begin with for purposes of explanation; but now we will change to a 'fore-and-aft' rig—that is, one with the mast at the forward edge or 'luff' of the sail, as in Fig. 91. Suppose the sail to be set at the angle shown, and the wind blowing as the arrow points. The boat cannot readily move sidewise, because of the broadside resistance; she does not move backward, because the wind is pressing on the aftermost side of the sail. So she very naturally moves forward. When she nears buoy No. 1, the helmsman moves the 'tiller,' or handle of the rudder, toward the sail. This causes the boat to turn her head toward buoy No. 2, the sail swings across to the other side of the boat and fills on that side, which now in turn becomes the aftermost, and she moves toward buoy No. 2 nearly at right angles to her former course. Thus, through a series of zig-zags, the wind is made to work against itself. This operation is called 'tacking,' or

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'working to windward,' and the act of turning, as at the buoys No. 1 and No. 2, is called 'going about.'

"It will be seen, then, that the science of sailing lies in being able to manage a boat with her head pointing at any possible angle to or from the wind. Nothing but experience can teach one all the niceties of the art, but a little aptitude and address will do to start with, keeping near shore and carrying little sail.

Simplest Rig Possible.

"I will suppose that the reader has the use of a broad, flat-bottomed boat without any rudder. (See Fig. 92.) She can-

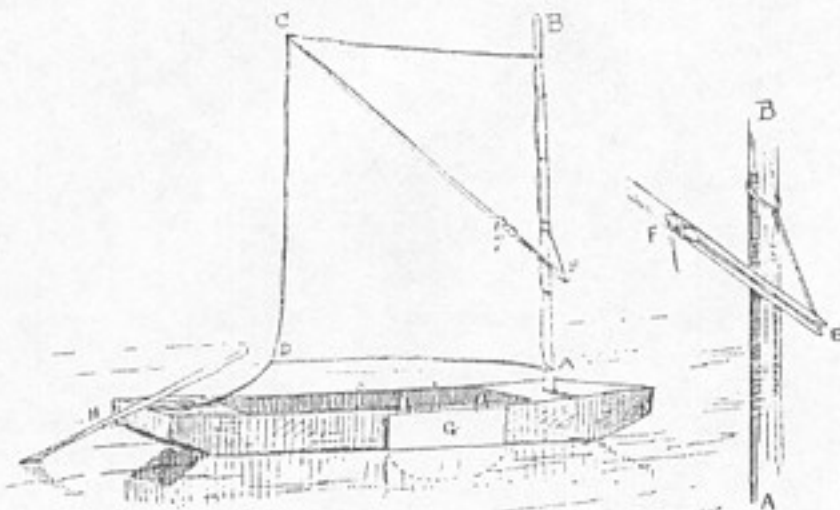


FIG. 92.

not be made to work like a racing yacht under canvas, but lots of fun can be had out of her.

"Do not go to any considerable expense at the outset. Procure an old sheet, or an old hay-cover, six or eight feet square, and experiment with that before spending your money on new

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material. If it is a sheet, and somewhat weakly in its texture, turn all the edges in and sew them, so that it shall not give way at the hems. At each corner sew on a few inches of strong twine, forming loops at the angles. Sew on, also, eyelets or small loops along the edge which is intended for the luff of the sail, so that it can be laced to the mast.

"You are now ready for your spars, namely, a mast and a 'sprit,' the former a couple of feet longer than the luff of the sail, and the latter to be cut off when you find how long you want it. Let these spars be of pine, or spruce, or bamboo—as light as possible, especially the sprit. An inch and a half diameter will do for the mast, and an inch and a quarter for the sprit, tapering to an inch at the top. To 'step' the mast, bore a hole through one of the thwarts (seats) near the bow, and make a socket or step on the bottom of the boat, just under the aforesaid hole—or if anything a trifle farther forward—to receive the foot of the mast. This will hold the mast upright, or with a slight 'rake' aft.

"Lace the luff of the sail to the mast so that its lower edge will swing clear by a foot or so of the boat's sides. Make fast to the loop at D a stout line, ten or twelve feet long. This is called the 'sheet,' and gives control of the sail. The upper end of the sprit, C, E, is trimmed so that the loop at C will fit over it but not slip down. The lower end is simply notched to receive a short line called a 'snotter,' as shown in the detailed drawing at the right of the cut (Fig. 92). It will be readily un-

derstood that, when the sprit is pushed upward in the direction of C, the sail will stand spread out. The line is placed in the notch at E and pulled up until the sail sets properly, when it is made fast to a cleat or to a cross piece at F. This device is in common use and has its advantages, but a simple loop for the foot of the sprit to rest in is more easily made and will do nearly as well. H is an oar for steering. Having thus de-

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scribed the simplest rig possible, we may turn our attention to more elegant and elaborate but not always preferable outfits.

Leg-of-Mutton Rig.

"One of the prettiest and most convenient rigs for a small boat is known as the 'leg-of-mutton sharpie rig' (Fig. 93). The sail is triangular, and the sprit, instead of reaching to its upper corner, stands nearly at right angles to the mast. It is held in position at the mast by the devices already described. This rig has the advantage of keeping the whole sail flatter than any other, for the end of the sprit cannot 'kick up,' as the phrase goes, and so the sail holds all the wind it receives.

"Fig. 94 shows a device, published for the first time in the *St. Nicholas Magazine* for September, 1880, which enables the sailor to step and unstep his mast, and hoist or lower his sail without leaving his seat—a matter of great importance when the boat is light and tottish, as in the case of that most beautiful of small craft, the modern canoe, where the navigator sits habitually amidships. The lower mast (A, B, Fig. 94) stands about two and a half feet above the deck. It is fitted at the head with a metal ferrule and pin, and just above the deck with two half-cleats or other similar devices (A). The topmast (C, D) is fitted at F with a stout ring, and has double halyards (E) rove through or around its foot. The lower mast being in position (see lower part of Fig. 94), the canoeist desiring to make sail brings the boat's head to the wind, takes the top-mast with the sail loosely furled in one hand, and the halyards in the other. It is easy for him by raising this mast, without leaving

his seat, to pass the halyards one on each side of the lower mast and let them fall into place close to the deck under the half-cleats at A. Then, holding the halyards taut enough to keep them in position, he will hook the topmast ring over the pin in the lower mast-head and haul away (see top part of Fig. 94). The mast will rise into place, where it is made fast. A collar of leather, or a knob of some kind, placed on the top-

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mast just below the ring, will act as a fulcrum when the halyards are hauled taut, and keep the mast from working to and fro.

"The advantages of the rig are obvious. The mast can be raised without standing up, and in case of necessity the halyards can be let go and the mast and sail unshipped and stowed below with the greatest

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ease and expedition, leaving only the short lower mast standing. A leg-of-mutton sail with a common boom along the foot is shown in the cut as the most easily illustrated application of the device, but there is no reason why it may not be applied to a sail of different shape, with a sprit instead of a boom, and a square instead of a pointed head.

"The Latteen Rig

is recommended only for boats which are 'stiff'—not tottish, that is. The fact that a considerable portion of the sail projects forward of the mast renders it awkward in case of a sudden shift of wind. Its most convenient

form is shown in Fig. 95. The arrangement for shipping and unshipping the yard is precisely like that shown in Fig. 94—a short lower mast with a pin at the top and a ring fitted to the yard. It has a boom at the foot which is joined to the yard at C by means of a hook or a simple lashing, having sufficient play to allow the two spars to shut up together like a pair of dividers. The boom (C, E) has, where it meets the short lower mast, a half-cleat or jaw, shown in detail at the bottom of the cut (Fig. 95), the circle representing a cross section of the mast. This should be lashed to the boom, as screws or bolts would weaken it. To take in sail, the boatman brings the boat to the wind, seizes the

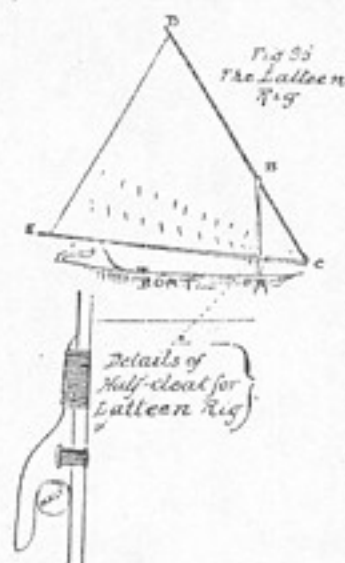


FIG. 95.—The Latteen Rig.

boom and draws it toward him. This disengages it from the mast. He then shoves it forward, when the yard (C, D) falls of its own weight into his hands, and can be at once lifted clear of

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the lower mast. To keep the sail flat, it is possible to arrange a collar on the lower mast so that the boom, when once in position, cannot slip upward and suffer the sail to bag.

"The Cat-Rig,

so popular on the North Atlantic coast, is indicated in Fig. 91. The spar at the head of the sail is called a 'gaff,' and, like the boom, it fits the mast with semicircular jaws. The sail is hoisted and lowered by means of halyards rove through a block near the mast-head. The mast is set in the bows—'chock up in the eyes of her,' as a sailor would say. A single leg-of-mutton sail will not work in this position, because the greater part of its area is too far forward of amidships. No rig is handier or safer than this in working to windward; but off the wind—running before, or nearly before it, that is—the weight of mast and sail, and the pressure of the wind at one side and far forward, make the boat very difficult and dangerous to steer. Prudent boatmen often avoid doing so by keeping the wind on the quarter and, as it were, tacking to leeward.

"This suggests the question of 'jibing,' an operation always to be avoided if possible. Suppose the wind to be astern, and the boat running nearly before it. It becomes necessary to change your course toward the side on which the sail is drawing. The safest way is to turn at first in the opposite direction, put the helm 'down' (toward the sail), bring the boat up into the wind, turn her entirely around, and stand off on the new tack. This, however, is not always possible. Hauling in the sheet until the sail fills on the other side is 'jibing;' but when this happens it goes over with a rush that sometimes carries mast and sheet or upsets the boat; hence the operation should be first undertaken in a light wind. It is necessary to know how to do it, for sometimes a sail insists upon jibing very unexpectedly, and it is best to be prepared for such emergencies.

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How to Make a Sail.

"For the sails of such boats as are considered in this paper, there is no better material than unbleached twilled cotton sheeting. It is to be had two and a half or even three yards wide. In cutting out your sail, let the selvedge be at the 'leech,' or aftermost edge. This, of course, makes it necessary to cut the luff and foot 'bias,' and they are very likely to stretch in the making, so that the sail will assume a different shape from what was intended. To avoid this, baste the hem carefully before sewing, and 'hold in' a little to prevent fulling. It is a good plan to tack the material on the floor before cutting, and mark the outline of the sail with pencil. Stout tape stitched along the bias edges will make a sure thing of it, and the material can be cut, making due allowance for the hem. Better take feminine advice on this process. The hems should be half an inch deep all around, selvedge and all, and it will do no harm to reinforce them with cord if you wish to make a thoroughly good piece of work.

"For running-rigging, nothing is better than laid or braided cotton cord, such as is used for awnings and sash-cords. If this is not easily procured, any stout twine will answer. It can be doubled and twisted as often as necessary. The smallest manila rope is rather stiff and unmanageable for such light sails

as ours.

"In fitting out a boat of any kind, iron, unless galvanized, is to be avoided as much as possible, on account of its liability to rust. Use brass or copper instead.

Hints to Beginners.

"Nothing has been said about reefing thus far, because small boats under the management of beginners should not be afloat in a 'reefing breeze.' Reefing is the operation of reducing

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the spread of sail when the wind becomes too fresh. If you will look at Fig. 95 you will see rows of short marks on the sail above the boom. These are 'reef-points'—bits of line about a foot long passing through holes in the sail, and knotted so that they will not slip. In reefing, the sail is lowered and that portion of it between the boom and the reef-points is gathered together, and the points are tied around both it and the boom. When the lower row of points is used it is a single reef. Both rows together are a double reef.

"Make your first practical experiment *with a small sail and with the wind blowing toward the shore*. Row out a little way, and then sail in any direction in which you can make the boat go, straight back to shore if you can, with the sail out nearly at right angles with the boat. Then try running along shore with the sheet hauled in a little, and the sail on the side nearest the shore. You will soon learn what your craft can do, and will probably find that she will make very little, if any, headway to windward. This is partly because she slides sidewise over the water. To prevent it you may use a 'lee-board'—namely, a broad board hung over the side of the boat (G, Fig. 92). This must be held by stout lines, as the strain upon it is very heavy. It should be placed a little forward of the middle of the boat. It must be on the side away from the wind—the lee side—and must be shifted when you go about. Keels and centre-boards are permanent contrivances for the same purpose, but a lee-board answers very well as a makeshift, and is even used habitually by some canoeists and other boatmen.

"In small boats it is sometimes desirable to sit amidships, because sitting in the stern raises the bow too high out of water; steering may be done with an oar over the lee side, or with 'yoke-lines' attached to a cross piece on the rudder-head, or even to the tiller. In this last case, the lines must be rove through rings or pulleys at the sides of the boat opposite

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the end of the tiller. When the handle of the oar (H, Fig. 92)—or the tiller (F, Fig. 95) if a rudder is used—is pushed to the right, the boat will turn to the left, and *vice versa*. The science of steering consists in knowing when to push and how much to push—very simple, you see, in the statement, but not always so easy in practice.

"The sail should be so adjusted in relation to the rest of the boat that, when the sheet is hauled close in and made fast, the boat, if left to herself, will point her head to the wind like a weather-cock, and drift slowly astern. If it is found that the sail is so far forward that she will not do this, the fault may be remedied by stepping the mast further aft, or by rigging a small sail near the stern. This is called a 'dandy,' or 'steering-sail,' and is especially convenient in a boat whose size or arrangement necessitates sitting amidships. It may be rigged like the mainsail, and when its sheet is once made fast will ordinarily take care of itself in tacking.

"Remember that, if the wind freshens or a squall strikes you, the position of safety is with the boat's head to the wind.



FIG. 96.

When in doubt what to do, push the helm down (toward the sail) and haul in the slack of the sheet as the boat comes up into the wind. If she is moving astern, or will not mind her helm—and of course she will not if she is not moving—

pull her head around to the wind with an oar, and experiment cautiously until you find which way you can make her go.

"In making a landing, always calculate to have the boat's head as near the wind as possible when she ceases to move. This whether you lower your sail or not.

"Thus, if the wind is off shore, as shown at A, Fig. 96, land

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at F or G, with the bow toward the shore. If the wind is from the direction of B, land at E with the bow toward B, or at F; if at the latter, the boom will swing away from the wharf and permit you to lie alongside. If the wind is from D, reverse these positions. If the wind comes from the direction of C, land either at F or G, with the bow pointing off shore.

"If you have no one to tell you what to do, you will have to feel your way slowly and learn by experience; but if you have nautical instincts you will soon make your boat do what you wish her to do as far as she is able. *But first learn to swim before you try to sail a boat.*"

Volumes have been written on the subject treated in these few pages, and it is not yet exhausted. The hints here given are safe ones to follow, and will, it is hoped, be of service to many a young sailor in many a corner of the world.

CHAPTER XIV.

NOVELTIES IN SOAP-BUBBLES.

Every Boy His Own Bubble Pipe.



Every Boy his own Bubble Pipe.

"A SOAP-BUBBLE" is an uncouth, inelegant name for such an ethereal, fairy sphere. It is such a common, every-day sight to us that we seldom give it much attention or realize how wonderful and beautiful is this fragile, transparent, liquid globe. Its spherical form is typical of perfection, and the ever-changing, prismatic colors of its iridescent surface charm the eye.

It is like a beautiful dream; we are entranced while it lasts, but in an instant it vanishes and leaves nothing to mark its former existence except the memory of its loveliness.

Few persons can stand by and watch another blowing bubbles without being seized with an uncontrollable desire to blow one for themselves. There is a peculiar charm or pleasure in the very act which not many who have known it ever outgrow. At the present time "soap-bubble parties" are becoming quite

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fashionable. At one of these gatherings the guests, old and young, furnished with clay pipes, stand around a table, in the centre of which is placed a fancy punch bowl filled—not with a mixture of ardent spirits, but soapsuds. Prizes are awarded to those among the guests who successfully launch in air the largest bubble, and to those who keep theirs flying for the greatest length of time or send them the highest. As may be imagined, these parties are very amusing, and everybody at first tries to prevent his or her neighbor from succeeding, until, amid great merriment and confusion, the hostess announces that if her guests expect the prizes to be awarded, a rule must be enacted compelling them to pay more attention to their own efforts and not allowing them to molest each other.

It is generally known that a bubble will burst if it touch any hard or smooth surface, but upon the carpet or a woollen cloth it will roll or bounce merrily.

If you take advantage of this fact you can with a woollen cloth make bubbles dance and fly around as lively as a juggler's gilt balls, and you will be astonished to find what apparently rough handling these fragile bubbles will stand when you are careful not to allow them to touch anything but the woollen cloth.

It may be worth remarking that the coarser the soap the brighter the bubbles will be. The compound known as "soft soap" is by some persons considered the best for the purpose.

In the accompanying illustrations are shown two kinds of soap-bubbles.

One of the pictures shows how to transform your bubble into an aerial vapor balloon.

If you wish to try this pretty experiment, procure a rubber tube, say a yard long, and with an aperture small enough to require considerable stretching to force it over the gas-burner. After you have stretched one end so as to fit tightly over the

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burner, wrap the stem of a clay pipe with wet paper and push it into the other end of the tube, where it must fit so as to allow no gas to escape. Dip the bowl of your pipe into the suds and turn the gas on; the force of the

gas will be sufficient to blow the bubble for you, and, as the gas is lighter than the air, the bubble, when freed from the pipe, will rapidly ascend and never stop in its upward course until it perishes.

Old Uncle Cassius, an aged negro down in Kentucky, used to amuse the children by making smoke-bubbles.

Did you ever see smoke-bubbles? In one the white-blue smoke, in beautiful curves, will curl and circle under its crystal shell. Another will possess a lovely opalescent, pearly appearance, and if one be thrown from the pipe while quite small and densely filled



Gas-bubble.

with smoke, it will appear like an opaque polished ball of milky whiteness. It is always a great frolic for the children when they catch Uncle Cassius smoking his corn-cob pipe. They gather around his knee with their bowl of soapsuds and bubble pipes, and while the good-natured old man takes a few lusty whiffs from his corn-cob and fills his capacious mouth with

tobacco smoke, one of the children dips a pipe into the suds, starts the bubble and passes it to Uncle Cassius. All then stoop down and watch the gradual growth of that wonderful smoke-bubble; and when "Dandy," the dog, chases and catches one of these bubbles, how the children laugh to see the astonished and injured look upon his face, and what fun it is to see him sneeze and rub his nose with his paw!

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The figure at the head of this chapter shows you how to make a giant bubble. It is done by first covering your hands well with soapsuds, then placing them together so as to form a cup, leaving a small opening at the bottom. All that is then necessary is to hold your mouth about a foot from your hands and blow into them. I have made bubbles in this way twice the size of my head. These bubbles are so large that they invariably burst upon striking the floor, being unable to withstand the concussion.

Although generally considered a trivial amusement, only fit for young children, blowing soap-bubbles has been an occupation appreciated and indulged in by great philosophers and men of science, and wonderful discoveries in optics and natural philosophy might be made with only a clay-pipe and a bowl of soapsuds.

CHAPTER XV.

FOURTH OF JULY BALLOONS WITH NEW AND NOVEL ATTACHMENTS.

DID you ever, while watching a beautiful soap-bubble dance merrily through the air, think how closely it resembled the immense silken bubble beneath which the daring aeronaut goes bounding among the clouds?

Especially is this true of the gas-bubble described in the foregoing chapter. When a boy the author's ambition naturally led him from these vapor balloons to experimenting in

more lasting material than soap-suds. He then devoted his attention for some time to paper balloons, and, after numerous experiments and disasters, succeeded in building balloons of a style which is comparatively safe from accident and seldom the cause of a mortifying failure. If you do not want to disappoint the spectators by having a fire instead of an ascension, avoid models with small

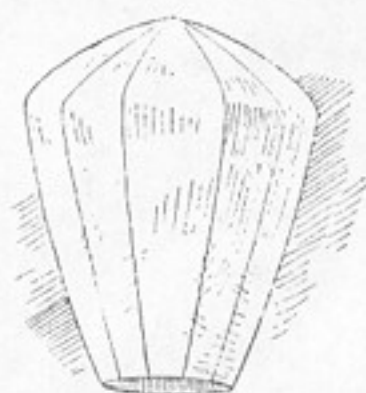


Too long a neck (unsafe).

mouth-openings or narrow necks. Experience has also taught the writer that balloons of good, substantial, portly build go up best and make their journey in a stately, dignified manner, while the slim, narrow balloon, on the contrary, even if it suc-

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ceeds in getting a safe start, goes bobbing through the air, turning this way and that, until the flame from the fire-ball



Too Square and Narrow (unsafe).



Too Narrow (unsafe).

touches and lights the thin paper, leaving only a handful of ashes floating upon the summer breeze.

The reader can see here illustrated some of the objectionable



Round Balloon (safe).



Slightly Elongated Balloon (safe).

shapes as well as some of the safe styles. For large balloons, strong manila-paper is best ; for smaller ones, use tissue-paper

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When you build a balloon, decide first what height you want it ; then make the side pieces or gores nearly a third longer ; a

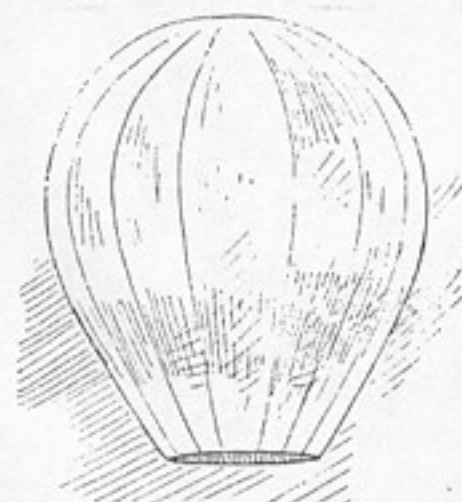


Pumpkin-shaped Balloon (safe).

balloon of thirteen gores, each six feet long and one foot greatest width, when distended with hot air ready to ascend, is a little over four feet high. For such a balloon, first make a pattern of stiff brown paper by which to cut the gores. To make the pattern, take a strip of paper six feet long and a little over one foot wide ; fold the paper in the centre length-

wise, so that it will be only slightly over a half foot from the edges to the fold. Along the bottom measure two inches from the fold and mark the point.

At one foot from the bottom, at right angles from the folded edge, measure three inches and one-half, and mark the point ; in the same manner mark off five inches from two feet up the fold. From a point three feet four inches from the bottom measure off six inches and mark the point ; from this place the width decreases. At the fourth foot mark a point five inches and one-half from



Regular-shaped Balloon (safe).

the fold ; about three inches

and a third at the fifth foot ; nothing, of course, at the sixth foot, or top, where the gore will come to a point. With chalk

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or pencil draw a curved line connecting these points ; cut the paper along this line and unfold it.

You will have a pattern the shape of a cigar, four inches



FIG. 97.—Single Gore.

wide at the bottom, one foot greatest width, and six feet long. After pasting your sheets of manila or tissue-paper together in strips of the required length cut out thirteen gores by the pattern just made ; lay one of these gores flat upon the floor, as in

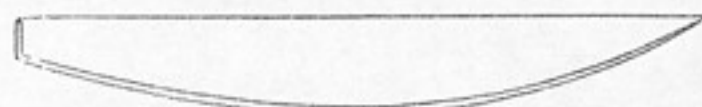


FIG. 98.—Single Gore Folded.

Fig. 97 ; fold it in the centre, as in Fig. 98 ; over this lay another gore, leaving a margin of the under gore protruding from beneath (Fig. 99). With a brush cover the protruding edge with paste, then turn it up and over upon the upper gore, and with



FIG. 99.—Folded Gore with a second Gore over it, ready for Pasting.

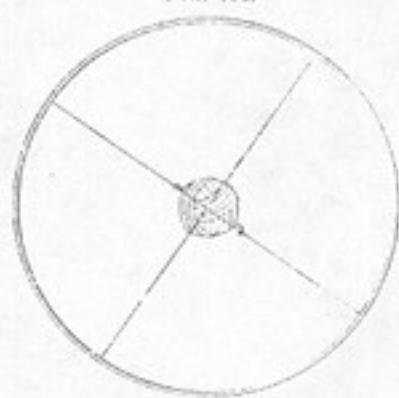
a towel or rag press it down until the two edges adhere. Fold the upper gore in the centre as you did the first one, and lay a third gore upon it ; paste the free protruding edge ; and so on

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until all thirteen are pasted. It will be found that the bottom gore and top gore have each an edge unpasted ; lay these two edges together and paste them neatly.

Next you must make a hoop of rattan or some light substance to fit the mouth opening, which will be about one foot and a half in diameter. Fasten the hoop in by pasting the edges of the mouth opening around it. In

FIG. 100.



Top View of Hoop and Cross Wire.



Wick-ball.



Side View of Hoop showing Wick-ball hung in place.

very large paper balloons it is well to place a piece of string along the edge of each gore and paste it in, letting the ends of the strings hang down below the mouth; fasten the hoop in with these ends before pasting the paper over it. It will be found next to impossible to tear the hoop from a balloon, strengthened in this manner, without totally destroying the balloon.

Should you discover an opening at the top of your balloon, caused by the points not joining exactly, tie it up with a string if it be small, but if it be a large

hole paste a piece of paper over it. When dry, take a fan and fan the balloon as full of air as you can, and while it is inflated make a thorough inspection of all sides to see that there are no accidental tears, holes or rips.

Fig. 100 shows the cross wires that support the fire-ball. The latter is best made of old-fashioned lamp-wick wound, rather loosely, in the form of a ball, the size depending upon the dimensions of the balloon. The sponge commonly used

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soon burns out and the balloon comes down in a very little while; but the wick-ball here described seldom fails to propel the little air-ship upward and onward out of sight. A short, fine wire should next be run quite through the wick-ball, so that it can be attached to the mouth of the balloon in an instant by hooking the ends of this wire over the cross wires at the mouth.

If you use a little care you will have no difficulty in sending up the balloon. Place your wick-ball in a pan or dish, put the corked bottle of alcohol beside it, and about thirty feet away make a simple fire-place of bricks or stones, over which place a piece of stove-pipe. Fill the fire-place with shavings, twisted pieces of paper, or anything that will light readily and make a good blaze. In a loop of string fastened at the top of the balloon for that purpose let one of the party put the end of a smooth stick, and, with the other end in his hand, mount some elevated position and hold the balloon over the fire-place. Before touching a match to the combustibles below, expand the balloon as much as possible by fanning it full of air; then light the fire. Be very careful, in all the process that follows, to hold the mouth of the balloon directly above and not too near the stove-pipe, to prevent the blaze from setting fire to the paper, which will easily ignite. At this stage of the proceedings one person must take the bottle of alcohol, uncork it, and pour the contents over the wick-ball in the basin, and the ball must be made to soak up all it will hold of the spirits. The balloon will become more and more buoyant as the air becomes heated inside, and at length, when distended to its utmost, it will begin pulling to free itself. Holding the hoop at the mouth, walk to one side of the fire and with all speed have the ball attached securely in place. Touch a light to it, and it will blaze

up. At the words "All right," let go. The same instant the stick must be slid from the loop on top, so as not to tear

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the paper, and away will sail the balloon upon its airy voyage.

Never attempt to send up a balloon upon a windy day, for the wind will be sure, sooner or later, to blow the blaze aside and set the paper on fire, and if once it catches up in the air there is not much use in trying to save it.

After you have made a balloon like the one just described and sent it up successfully, you can try other shapes. A very good plan in experimenting is to make a small working model

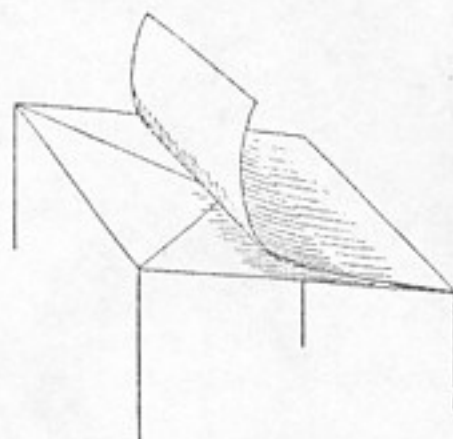


FIG. 101.—Method of pasting Paper and Strings for Parachute.

of light tissue-paper, fill it with cold air by means of an ordinary fan, and when it is expanded any defect in form or proportion can be readily detected and remedied. If it be too narrow, cut it open at one seam and put in another gore, or *vice versa*, until you are satisfied with the result; with this as a pattern, construct your larger balloon.

Such a model, eighteen inches high, lies upon the writer's table. He has sent it up in the house several times by holding it a few moments over a burning gas-jet. The balloon rapidly fills with heated air, and when freed soars up to the ceiling, where it rolls along until the air cools, then falls gently to the floor.

The parachute shown in the tail-piece is simply a square piece of paper with a string at each of the four corners, meeting a short distance underneath, where a weight is attached. Fig. 101 shows how to make one that will not tear. It is made of two square pieces of paper. Two pieces of string are laid diagonally across the first paper; on top of this the second piece of

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paper is pasted, enclosing the strings without disturbing them; the ends of the strings come out at the corners.

These parachutes are attached to a wire that hangs from the balloon in this manner: From the centre and top of the parachute is a string, we will say, a foot long; this is tied securely to one end of the large fuse from a pack of Chinese fire-crackers; a few inches from the other end of the fuse another string is tied and fastened to the wire. Just as the balloon starts the free end of the fuse is lighted (Fig. 102). When it has burned itself away past the point where the lower string has been fastened, it of course severs the connection between the parachute and the balloon, and the parachute drops, but does not go far, before the air beneath spreads it out, the weight at the bottom balances it, and it floats away slowly, settling lower and lower, but often travelling miles before finally reaching the earth.

All manner of objects may be attached to a parachute—notes addressed to possible find-



FIG. 102.—Parachute attached to the Fuse and Wire.

ers, letters, or figures of men or animals. The latter look very odd in the air.

A real passenger balloon may be very closely imitated by painting crossed black lines upon the upper part of a paper balloon to represent the net-work. A pasteboard balloon-car, made after the manner shown in Fig. 103, and holding two pasteboard men cut out as shown in Fig. 104, may be hung on by hook-

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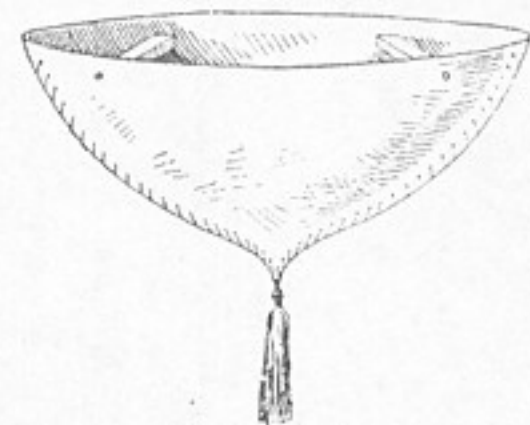


FIG. 103.—The Car.

may be fastened to the balloon by a long string and wire, and when it goes swinging after the larger light above, it has a curious appearance. In a similar manner, a long string of lanterns may be hung on to a large balloon, or packs of Chinese crackers may be exploded in mid-air by means of a fuse.

The writer has experimented in other fireworks, but found them very dangerous to handle. Mr. Stallknecht, of the *Hat, Cap and Fur Trade Review*, how-

ever, showed the author how to make a simple, safe, and beautiful pyrotechnic out of a Roman candle with colored balls, a piece of wire and a fuse. The fuse used can be bought in almost any city or town ;

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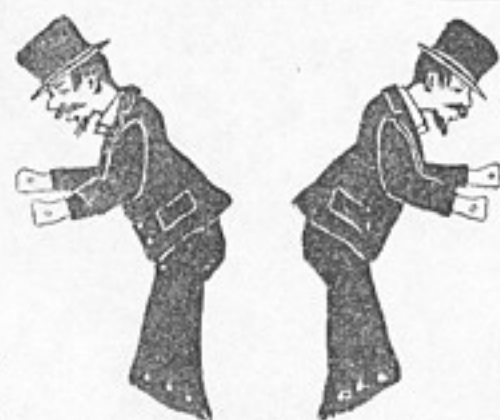
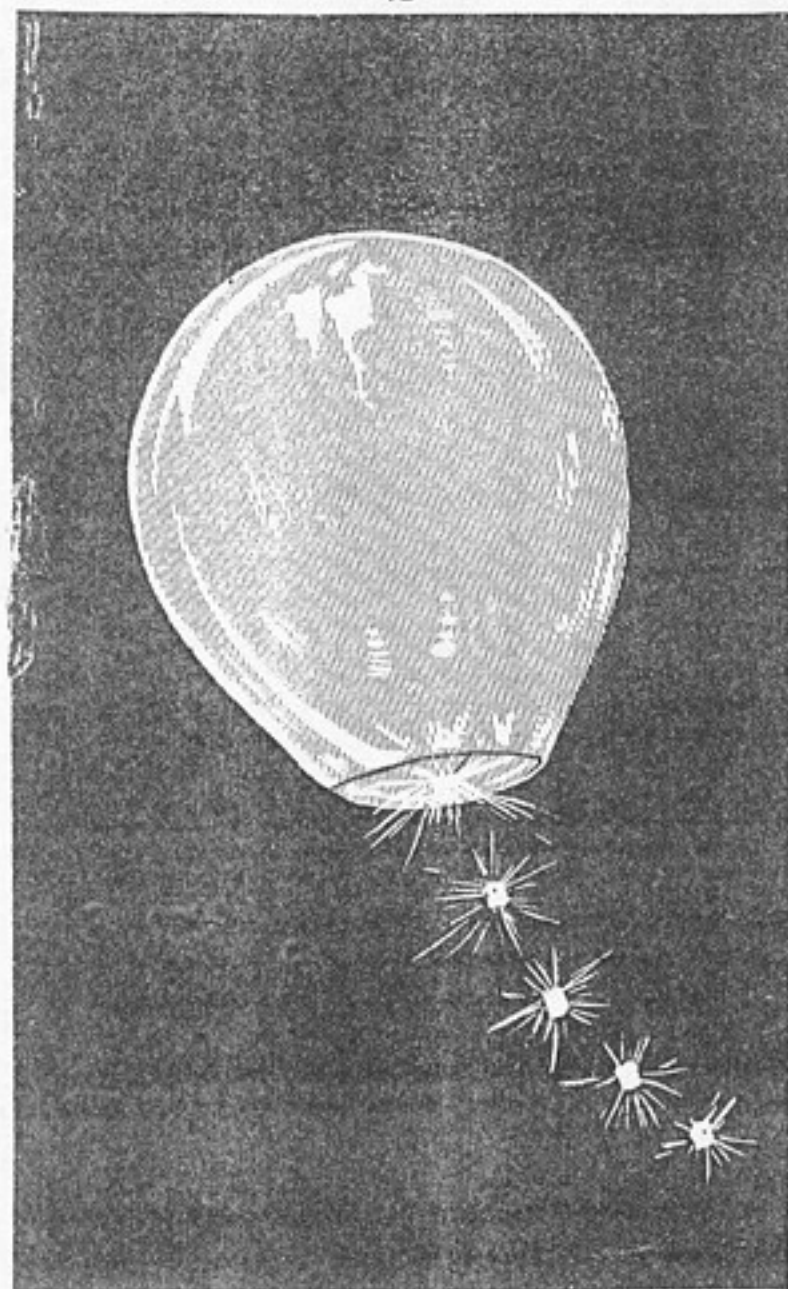


FIG. 104.—A Couple of Aëronauts.



Night Balloon.

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it is sold to miners for setting off blasts. With the wire make a sort of wheel, with two or three spokes ; cut open the Roman candle and extract the powder and balls ; wrap up each ball with some of the powder loosely in a piece of tissue-paper and tie the paper at the ends upon the spokes or cross wires of the wheel, as shown in Fig. 105. Run the fuse spirally around, passing through each parcel containing a ball, and allow the long end of the fuse to

CHAPTER XVI.

HOW TO CAMP OUT WITHOUT A TENT.

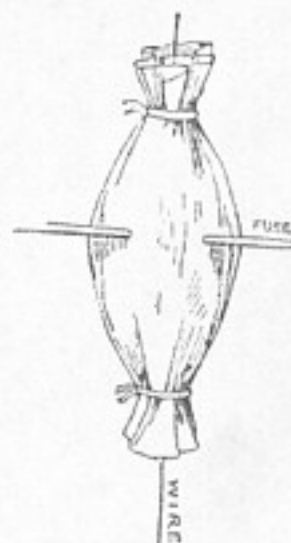


FIG. 105.

trail down beneath from the centre or side (Fig. 106). To the rim of the wire wheel attach several wires of equal lengths with hooked ends; hook these on to the hoop at the mouth of the balloon just before letting it go, and light the trailing end of the fuse. As the fire creeps slowly

along, the balloon mounts higher and higher. Suddenly the whole balloon glows with a ruddy, lurid glare. The fire has reached the first ball. In another instant you see a floating globe of pale green light, then blue, and so on, until all the balls are consumed. Showers of pretty, jagged sparks are falling constantly during the illumination, caused by the burning powder. By the time all is over the tiny light of the solitary ball in the balloon looks like a star in the sky above,

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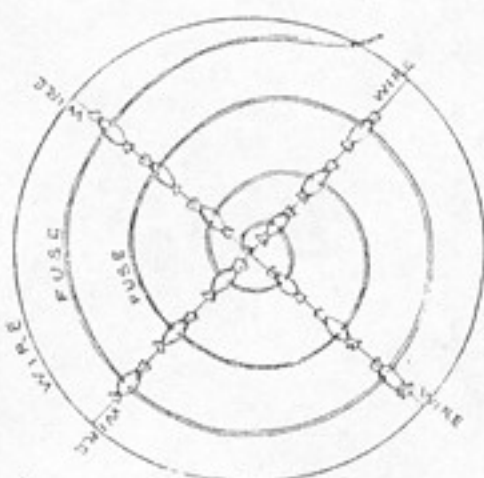


FIG. 106.—Fireworks.



Through the Clouds.

travelling where the wind chooses to blow it. The most experienced aeronaut has but very little more command over the actions of his immense si'ken air-ship than has the young amateur who builds his balloon of tissue-paper and sends it skyward with a ball of fire for its motive power.

THE next best thing to really living in the woods is talking over such an experience. A thousand little incidents, scarcely thought of at the time, crowd upon my mind, and bring back with them the feeling of freedom and adventure so dear to the heart of every boy. Shall I ever enjoy any flavor earth can afford as we did our coffee's aroma? The flapjacks—how good and appetizing! the fish—how delicate and sweet! And the wonderful cottage of boughs, thatched with the tassels of the pine—was there ever a cottage out of a fairy tale that could compare with it?

In fancy I can see it now. There stands the little cot, flooded with the light of the setting sun; those who built it and use it for a habitation are off exploring, hunting, fishing, and foraging for their evening meal, and the small, shy creatures of the wood take the opportunity to satisfy the curiosity with which they have, from a safe distance, viewed the erection of so large and singular a nest.

The boys will soon return, each with his contribution to the larder—a fish, a squirrel, a bird, or a rabbit, which will be cooked and eaten with better appetite and enjoyment than the most elaborate viands that home could afford. And although such joys are denied to me now, I can, at least, in remembering them, give others an opportunity to possess similar pleasures. It shall be my object to describe how these houses may be built and these dinners cooked, and that, too, where there are

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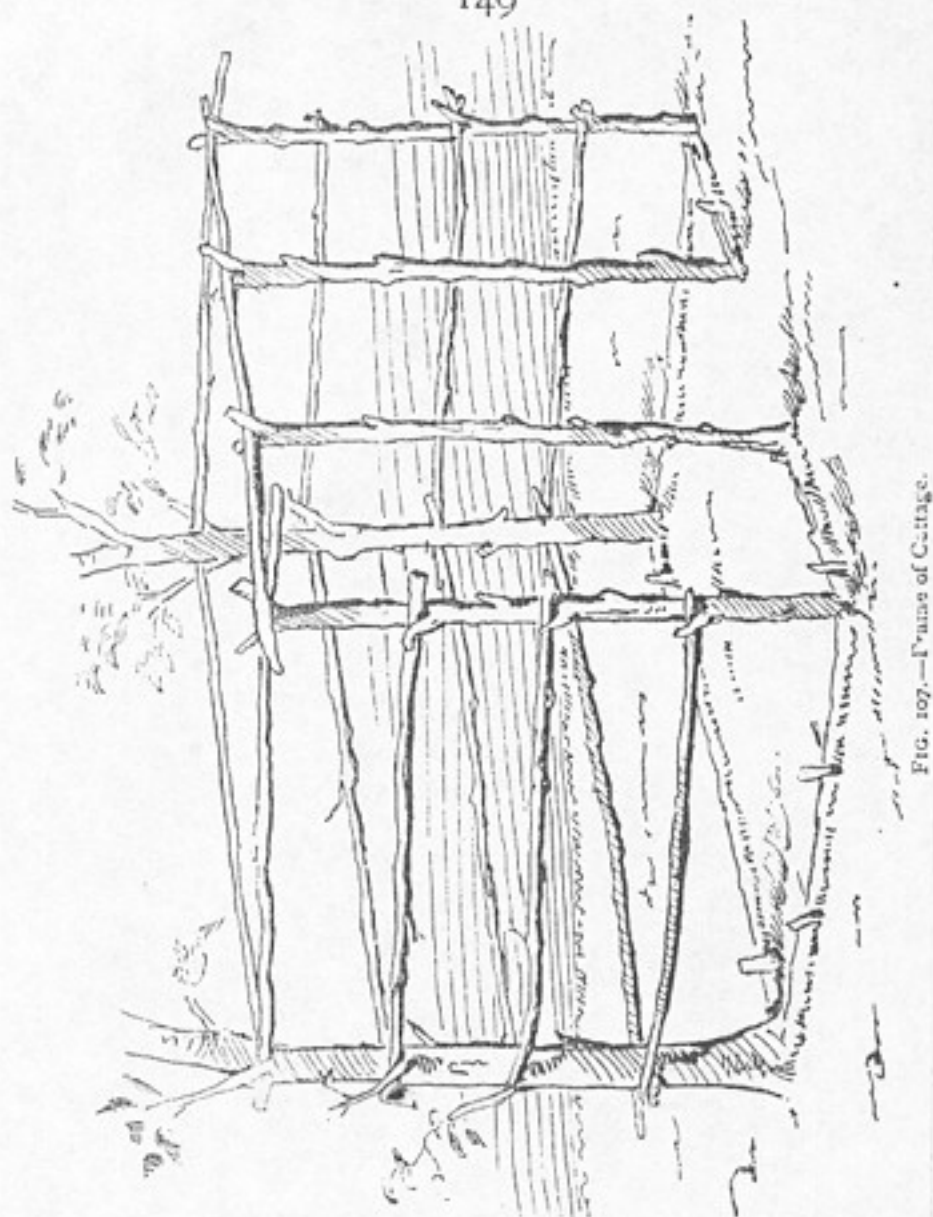


FIG. 107.—Frame of Cottage.

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neither planks, nor nails, nor stoves. To boys well informed in woodcraft, only a few hints need be given; but for the benefit of amateurs we will go more into detail.

Four persons make a good camping-party. Before arriving at their destination these persons should choose one of their number as captain.

The captain gives directions and superintends the pitching of the tent or the building of the rustic cottage. The site for the camp should be upon a knoll, mound, or rising ground, so as to afford a good drainage. If the forest abounds in pine trees, the young cottage-builder's task is an easy one. It often happens that two or three trees already standing can be made to serve for the corners of the proposed edifice, though trees for corners are not absolutely necessary.

Fig. 107 represents part of the framework of one of the simplest forms of rustic cottage. In this case, two trees serve for the two posts of the rear wall. The front posts are young trees that have been cut down and firmly planted at about four or five paces in front of the trees, as shown in the illustration. Enough of the branches have been left adhering to the trunks of the upright posts to serve as rests for the cross bars. To prevent complication in the diagram, the roof is not shown. To make this, fasten on an additional cross bar or two to the rear wall, then put a pole at each side, slanting down from the rear to the front, and cover these poles with cross sticks. When the framework is finished, the security and durability of the structure will be improved by fastening all the loose joints, tying them together with withes of willow, grass, or reeds. The next step is to cover the frame. This is done after the method shown in Fig. 108. From among some boughs, saved for this purpose, take one and hang it upon the third cross bar, counting from the ground up; bring the bough down, passing it inside the second bar and resting the end on the

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ground outside the first bar; repeat this with other boughs until the row is finished. Then begin at the fourth bar, passing the boughs down inside the third and outside the second bar, so that they will overlap the first row. Continue in this man-

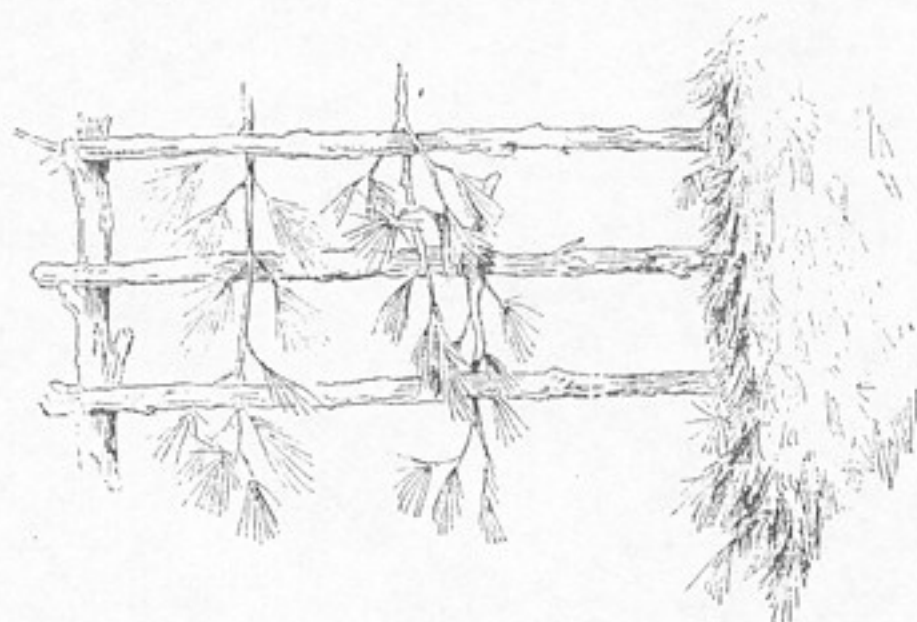


FIG. 108.—The way to Thatch.

ner until the four walls are closed in, leaving spaces open where windows or doors are wanted. The roof is thatched after the same method, beginning at the front and working upward and backward to the rear wall, each row overlapping the preceding row of thatch. The more closely and compactly you thatch

the roof and walls, the better protection will they afford from any passing shower. This completed, the house is finished, and you will be astonished to see what a lovely little green cot you have built.

A cottage may be built differing from the one we have just described by having the roof extended so as to form a sort of

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verandah, or porch, in front; the floor of the porch may be covered with a layer of pine-needles. Should you find your house too small to accommodate your party, you can, by erecting a duplicate cottage four or five paces at one side, and roofing over the intervening space, have a house of two rooms with an open hall-way between.

Before going to housekeeping, some furniture will be necessary; and for this we propose to do our shopping right in the neighborhood of our cottage. Here is our cabinet and upholstery shop, in the wholesome fragrance of the pines.

After the labor of building, your thoughts will naturally turn to a place for sleeping. Cut four forked sticks, sharpen the ends, and drive them firmly into the ground at the spot where you wish the bed to stand in your room. Two strong poles, long enough to reach lengthwise from fork to fork, will serve for side boards; a number of short sticks will answer for slats; after these are fastened in place you have the rustic bedstead shown in Fig. 109. A good spring mattress is very desirable,

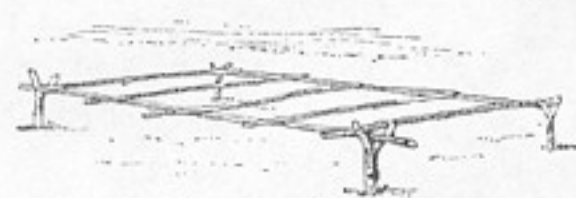


FIG. 109.—Bedstead.

and not difficult to obtain. Gather a lot of small green branches, or brush, and cover your bedstead with a layer of it about one foot

thick; this you will find a capital substitute for springs. For your mattress proper, go to your upholstery shop under the pine tree and gather several armfuls of the dry pine-needles; cover the elastic brush *springs* with a thick layer of these needles; over this spread your India-rubber blanket, with the rubber side under, so that any moisture or dampness there may be in your mattress may be prevented from coming through. You may now make up your bed with what wraps or blan-

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kets you have with you, and you have (Fig. 110) as complete and comfortable a bed as any forester need wish for. In the place of pine-needles, hay or grass may be used. I have slept very comfortably upon a brush mattress covered with iron-weed.*

I would suggest to any boy who means to try this rustic cabinet-making, to select carefully for the bed-posts sticks strong enough to support the weight he intends them to bear, otherwise his slumbers may be interrupted in an abrupt and disagreeable manner. My first experiment in this line proved disastrous. I spent the greater part of one day in building and neatly finishing a bed like the one described. After it was made up, with an army blanket for a coverlid, it looked so soft, comfortable, and inviting that I scarcely could wait for bedtime to try it.

When the evening meal was over and the last story told

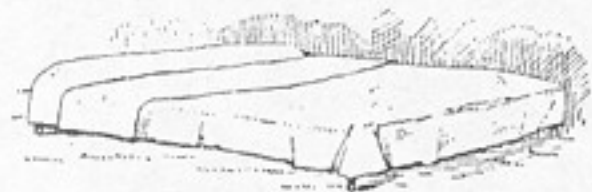


FIG. 110.—Bed made up.

around the blazing camp-fire, I took off hat, coat, and boots and snuggled down in my new and original couch, curiously watched by my companions, who lay, rolled in their blankets, upon the hard ground. It does not take a boy long to fall asleep, particularly after a hard day's work in the open air, but it takes longer, after being aroused from a sound nap, for him to get his wits together—especially when suddenly dumped upon the ground with a crash, amid a heap of broken sticks and dry brush, as I happened to be on that eventful night. Loud and long were the shouts of laughter of my companions

* Iron-weed; flat-top (*Vernonia noveboracensis*); a common Kentucky weed, with beautiful purple blossoms.

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when they discovered my misfortune. Theoretically, the bed was well planned, but practically it was a failure, because it had rotten sticks for bed-posts.

Having provided bed and shelter, it is high time to look after the inner boy; and while the foragers are off in search of provisions, it will be the cook's duty to provide some method of cooking the food that will be brought in.

One of the simplest and most practical forms of bake-oven can be made of clay and an old barrel. Remove one head of the barrel, scoop out a space in the nearest bank, and fit the barrel in (Fig. 111). If the mud or clay is not damp enough,

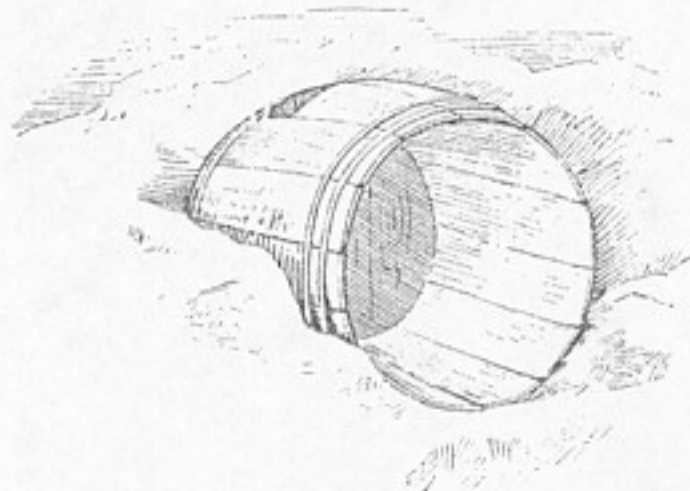


FIG. 111.—Barrel in Bank.

moisten it and plaster it over the barrel to the depth of a foot or more, leaving a place for a chimney at the back end, where part of a stave has been cut away; around this place build a chimney of sticks arranged log-cabin fashion and plastered with mud (Fig. 112). After this, make a good, rousing fire in the barrel, and keep adding fuel until all the staves are burned out and the surrounding clay is baked hard. This makes an oven

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that will bake as well, if not better, than any new patented stove or range at home. To use it, build a fire inside and let it burn until the oven is thoroughly heated, then rake out all the coal and embers, put your dinner in and close up the front with the head of the barrel preserved for this purpose. The clay will remain hot for several hours and keep the inside of the oven hot enough to roast meat or bake bread.

If there be no bank convenient, or if you have no barrel with which to build this style of oven, there are other methods that will answer for all the cooking necessary to a party of boys camping out. Many rare fish have I eaten in my time. The

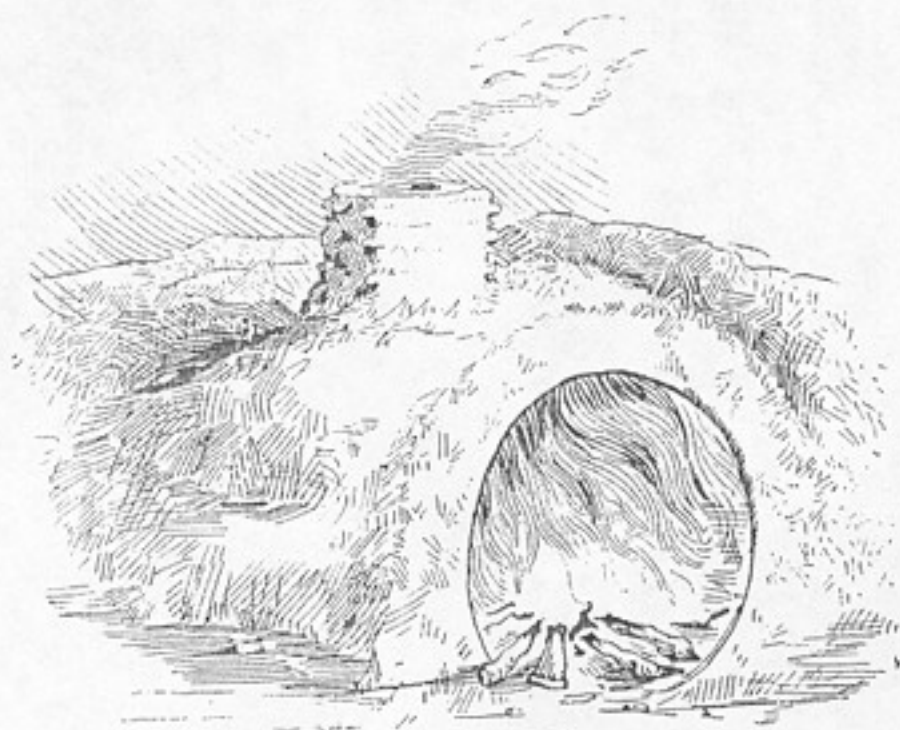


FIG. 112.—Heating the Oven.

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delicious pompano at New Orleans, the brook-trout and grayling, fresh from the cold water of Northern Michigan, but never



FIG. 113.—A Stone Stove.

have I had fish taste better than did a certain large cat-fish that we boys once caught on a set-line in Kentucky. We built a fire-place of flat stones, a picture of which you have in Fig. 113, covered it with a thin piece of slate, cleaned the fish and with its skin still on, placed it upon the slate. When it was brown upon one side we turned it over until it was thoroughly cooked. With green sticks we lifted off the fish and placed it



FIG. 114.—A Butter-Knife.

upon a piece of clean bark; the skin adhered to the stone, and the meat came off in smoking, snowy

pieces, which we ate with the aid of our pocket-knives and rustic forks made of small green twigs with the forked ends sharpened.

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If stones cannot be had to answer for this stove, there still remains the old, primitive camp-fire and pot-hook. The very sight of this iron pot swinging over a blazing fire suggests soup, to eat which

with any comfort spoons are necessary. These are quickly and easily made by thrusting clam or mussel shells into splits made in the ends of sticks. A splendid butter-knife can be made from the shell of a razor-oyster with a little care in a similar manner (see Fig. 114).

If you stay any time in your forest home you can, by a little ingenuity, add many comforts and conveniences. I have

drawn some diagrams, as hints, in this direction. For instance, Fig. 115 shows the manner of making an excellent rustic chair of two stout poles and two cross poles, to which are fastened the ends of a piece of canvas, carpet or leather (Fig. 116), which, swinging loose, fits itself exactly to your form, making a most comfortable easy-chair in which to rest or take a nap after a hard day's tramp. It of-

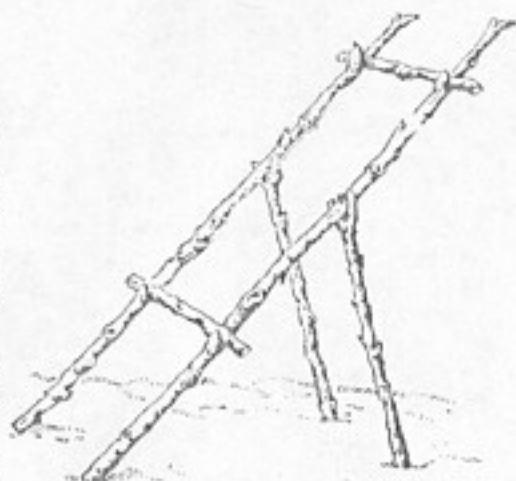


FIG. 115.—Frame of Rustic Chair.



FIG. 116.—The Rustic Chair Finished.

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ten happens that the peculiar formation of some stump or branch suggests new styles of seats. A table can be very readily made by driving four forked sticks into the ground for legs, and covering the cross sticks upon the top with pieces of birch or other smooth bark. Fig. 117 shows a table made in

this manner, with one piece of bark removed to reveal its construction.

As a general rule, what is taught in boys' books, though correct in theory, when tried

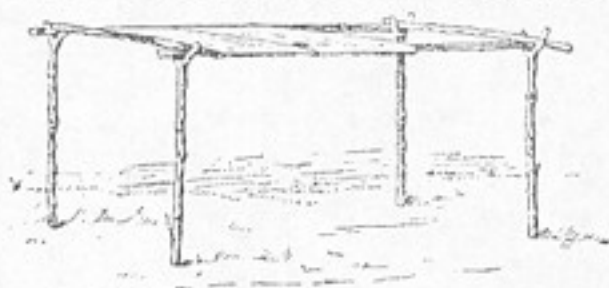


FIG. 117.—A Camp Table.

proves impracticable. This brings to mind an incident that happened to a party of young hunters camping out in Ohio. Early one morning one of the boys procured from a distant farm-house a dozen pretty little white bantam eggs. Having no game, and only one small fish in the way of fresh meat, the party congratulated themselves upon the elegant breakfast they would make of fresh eggs, toasted crackers, and coffee. How to cook the eggs was the question. One of the party proposed his plan.

"I have just read a book," said he, "which tells how some travellers cooked fowls and fish by rolling them up in clay and tossing them into the fire. Shall we try that plan with the eggs?"

The rest of the party assented, and soon all were busy rolling rather large balls of blue clay, in the centre of each of which was an egg. A dozen were placed in the midst of the hottest embers, and the boys seated themselves around the fire, impa-

tiently waiting for the eggs to cook. They did cook—with a vengeance! Zip, bang! went one, then another and another, until, in less time than it takes to tell it, not an egg remained unexploded; and the hot embers and bits of clay that stuck to

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the boys' hair and clothes were all that was left to remind them of those nice, fresh bantam eggs. It was all very funny, but ever after the boys of that party showed the greatest caution in trying new schemes, no matter how well they might seem to be endorsed.

Hints to Amateur Campers.

From time immemorial it has been the custom of the city fellows to laugh at their country cousins, and to poke all manner of fun at them on account of their verdancy in regard to city manners and customs. This is hardly fair, for if a real city fellow be placed on a farm, or in the woods, his ignorance is just as laughable and absurd. It was only the other day I saw a young New York artist refuse to drink from a spring because something *was bubbling up at the bottom*. Experience is a great teacher. Even the artist just mentioned, after making himself sick upon stagnant water, would, no doubt, learn to select bubbling springs in the future. A few timely hints may, however, prevent many mishaps and unpleasant accidents.

Provisions.

It is always desirable to take as large a stock of provisions as can be conveniently transported. In these days of canned meats, soups, vegetables, and fruits, a large amount of provisions may be stored in a small space. Do not fail to take a plentiful supply of salt, pepper, and sugar; also bacon, flour, meal, grits, or hominy, tea, coffee, and condensed milk. If you have any sort of luck with your rod, gun, or traps, the forest and stream ought to supply fresh meat, and with the appetite only enjoyed by people who live out doors you can "live like a king."

Shelter.

Because I have described but one sort of shelter my readers must not suppose that it is absolutely necessary to build a

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cottage like the one described. On the contrary, there are a thousand different plans that will suggest themselves to fellows who are accustomed to camping out. The huts, or sheds, built of "slabs" by some of the Adirondack hunters are very convenient, but unless the open ends are protected, in time of a storm, the rain is apt to drive in and soak the inmates. The two sheds face each other, and in the middle of the space between the camp-fire blazes, throwing a ruddy light at night into both compartments.

By taking advantage of a rock, a fallen or uprooted tree, the work of building a hut is oftentimes materially lessened.

Tents, of course, are very handy and comfortable, and if obtainable should by all means be used. At least one or two good sharp hatchets should form a part of the equipment of every camp; it is astonishing, with their aid and a little practice, what a comfortable house may be built in a very short time.

Choosing Companions.

Never join a camping party that has among its members a single peevish, irritable, or selfish person, or a "shirk." Although the company of such a boy may be only slightly annoying at school or upon the play-ground, in camp the com-

panionship of a fellow of this description becomes unbearable. Even if the game fill the woods and the waters are alive with fish, an irritable or selfish companion will spoil all the fun and take the sunshine out of the brightest day. The whole party should be composed of fellows who are willing to take things as they come and make the best of everything. With such companions there is no such thing as "bad luck;" rain or shine everything is always jolly, and when you return from the woods, strengthened in mind and body, you will always remember with pleasure your camping experience.

CHAPTER XVII.

BIRD SINGERS, ETC.

VERY many amusing contrivances can be made of the most simple materials. I have seen boys pluck a blade of grass, and, by simply stretching it edgewise between their thumbs, make a musical instrument with which they could imitate the notes of a singing bird so closely as to perfectly deceive persons not in the secret. After placing the blade of grass, as shown by the illustration, put your lips to your thumbs at the hollow between the joints and blow. The result will be a shrill noise which, with very little practice, can be made to resemble the notes of different wild birds.



The Block Bird Singer.

The illustration (Fig. 118) shows an instrument made upon the same principle as the "bird singer" just described. The "block bird singer" consists of two blocks of pine small enough to fit between the front teeth of the operator. The blocks are hollowed out in the middle, as shown by A, Fig. 118.



FIG. 118.

Stretch a blade of grass across the hollow of one of the blocks and place the other block on top of it, as shown by B, Fig. 118.

Place the blocks between your teeth, and by drawing in and expelling your breath you can produce a series of shrill

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noises which, with practice, may be made to imitate the notes of a singing bird. A thin strip of writing-paper may be substituted for the blade of grass where the latter is hard to procure.

The Corn-stalk Fiddle.

The writing of the above title has sent me back to my boyhood with one great leap over the intervening years. In imagination I am again a barefooted youngster, with straw hat, short pants, and checked apron. Again I can experience the feeling of pride and importance as from my pocket comes the well-remembered jack-knife, with a great shining blade that

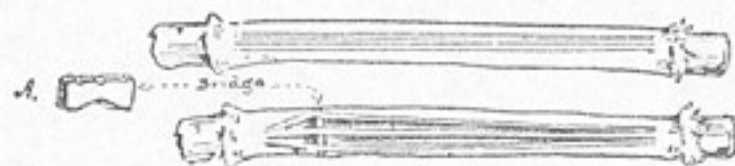


FIG. 119.—Cornstalk Fiddle.

opens, like any *man's* knife, with a snap! If I were this moment placed in a particular barn-yard in company with my reader, I could take him to the exact spot where a pile of corn-stalks

used always to be heaped up in the corner of the fence. Let us suppose we are there. Select a good straight corn-stalk, and with the "shiny" blade of the jack-knife cut four slits from joint to joint, as shown by the top diagram, Fig. 119. Now out of that chip at your feet make a wooden bridge like the one shown by A, Fig. 119. With the point of the jack-knife lift up the three strings of the fiddle and slide the bridge under them edgewise; then gently, but firmly, raise it to an upright position and spread the strings apart, allowing them to fit into the notches cut for the purpose in the bridge (see lower diagram, Fig. 119). Make the bow of a smaller corn-stalk than that used for the fiddle. No tune can be played

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upon this instrument, but a funny squeaking noise can be produced.

The squeak of the corn-stalk fiddle brings to my mind another rustic instrument.

The Pumpkin-vine Fife.

Cut a good thick, straight pumpkin-stem and make holes in it like those in a fife. If you know how to blow on a fife you may not only produce a noise with the pumpkin-stem, but a tune may be played upon this simple instrument which, even if only partially successful, will amuse your hearers to that degree that you will feel yourself amply repaid for the trouble.

A Pumpkin-vine Flute.

Cut off a long leaf-stem like the one shown in the illustration (Fig. 120). With the blade of your knife make a slit (A, B) through both sides of the stem. Then at the base of the leaf, in the solid part just beyond the end of the hollow in the stem, cut off the stem at C, D. By putting this end in the mouth and blowing, a noise will be produced, deep and sonorous, sounding like a distant steam-boat's whistle. Holes may be cut for the fingers similar to those just described for the fife.

If one stem fails to work, cut another and try it until you succeed. The pumpkin-vine flute, like the corn-stalk fiddle, will amuse small boys, but if my reader does not belong to that class he may make of a piece of fishing-cane a first-rate fife.

Cane Fife.

The fishing-pole being much harder material than the succulent pumpkin-vine stem, is proportionally more difficult to cut.

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If you can, borrow a real fife; select a piece of cane of about the same size, and cut the holes in one side of the cane, at the same distance apart as those in the real fife. Any hollow stick of the proper size will answer as a substitute for the piece of fishing-pole.

The Voice Disguiser

is made of a piece of corn-stalk about three inches long. After removing the pith cut a notch near each end, as shown in the illustration, upon opposite sides of the corn-stalk; upon the ends stretch a piece of fish-bladder, or any thin membrane; a piece of thin tracing-paper will answer. With a large pin make a hole in

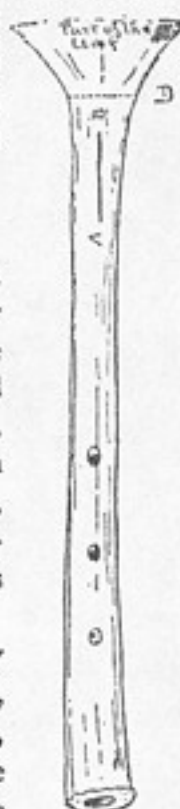
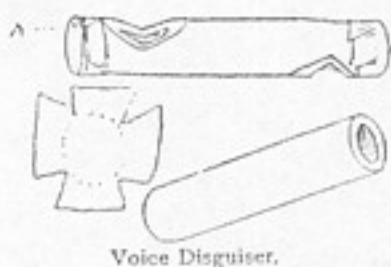


FIG. 120.—A Pumpkin-vine Flute.



Voice Disguiser.

each piece of membrane, as shown at A in the illustration. Now cover the notch, cut into the corn-stalk, with your mouth and laugh; the

noise you produce will set you laughing in earnest. By placing your mouth over either of the notches and talking or singing, the voice is so changed as to be perfectly disguised, and if you sing a song through this instrument it sounds like some one playing on a comb covered with paper. The voice disguiser is very handy in Punch and Judy or puppet shows.

The Locust Singer.

This little instrument, simple as it is, is calculated to afford considerable amusement.

With one of these toys can be made not only a loud noise, which in itself pleases most boys, but it reproduces exactly the sound of the *cicada*, or "locust," as the harvest-fly is commonly but improperly called. The "locust singer," as may be seen by reference to the illustration, consists of a horse-hair with a

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The Locust Singer.

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loop at one end and a weight attached to the other end. A pine stick, with a groove cut around it near the top, is thrust

through the loop of horse-hair, and the groove in the stick thickly covered with powdered rosin.

When the weight is swung rapidly around, the horse-hair, in sliding over the rosined stick, produces a noise which closely resembles the well-known song of the harvest-fly. If a tin pill-box is used for a weight and the hair run through a hole in the lid and fastened by a knot upon the inside, the lid of the box acts as a sort of sounding-board. A piece of parchment or paper is sometimes pasted over the box tightly, like a drum-head, and the hair attached to this; but a little stone wrapped in a piece of cloth answers every purpose.

A piece of kid, from a discarded glove, tied tightly over the top of a bottle-head, makes a loud-voiced locust singer. The head of the bottle may easily be removed, by striking repeated blows with a case-knife on the neck of the bottle, at the desired point of separation.

The Hummer.

This is somewhat similar to the toy just described, but even more simple in construction. It consists of a piece of shingle about an inch and one-half wide and five or six inches long, with a string attached to one end. When the hummer is swung around the head it makes a loud, buzzing noise.

CHAPTER XVIII.

BIRD NESTING.

How to Collect and Preserve Eggs.

AS regular as the seasons, is the flight of our feathered summer visitors; and their wonderful little nests can be found, by those who choose to look for them, in all manner of situations—in the grass, in the shrubs, in the trees, on the barren moor, on the face of the rocky cliff, in the sand banks, high up in the church steeple, under the low, overhanging eaves of the farmhouse or among the rafters of the hay-loft. Even the very chimneys of the dwellings are invaded by birds in search of a safe retreat where they can rear their little families undisturbed. Professor Rennie, in speaking of the apparent mechanical knowledge displayed by birds in the construction of their nests, says: "This work is the business of their lives—the duty which calls forth that wonderful ingenuity which no experience can teach and which no human skill can rival. The infinite variety of modes in which nests of birds are constructed, and the exquisite adaptation of the nests to the peculiar habits of the individual, offer a subject of almost exhaustless interest." I trust not one of my readers belong to that class of boys who wantonly destroy and pillage birds' nests, for which offence against good taste and good sense it is hard to find language strong enough to use in condemnation. Nor is it proper to start a collection of birds' eggs as the fancy seizes you, to amuse yourself for a time, afterward allowing the eggs to become broken and forgotten. If you really wish to make a collection of eggs for the purpose of study, there is no harm in taking a

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few nests and eggs for your cabinet. There are clauses in the game laws of most, if not all, of the States, which grant exceptional privileges to collectors for scientific purposes.

Eggs should be "blown," or emptied of their contents, as soon as collected, the empty shells being much less liable to break than the unblown egg. To blow eggs you should have an egg-

drill and blow-pipe, but if such instruments are out of your reach a pin will answer for a drill and your lips for the blow-pipe. Make a very small hole in each end of the egg, and taking it gently between the thumb and forefinger, place one hole to the lips; then blow, not too hard, but steadily, until the contents come out of the hole at the other end.

The use of the blow-pipe and drill not only simplifies the operation and lessens the chances of breaking the eggs, but it also makes much neater specimens. Hold the egg firmly, but gently, with its ends between the thumb and forefinger of the left hand. Apply the point of the drill to the middle of one side, and, by imparting a twirling motion to the instrument, drill a hole in the egg-shell, filing away the shell gradually until the opening is large enough to admit the end of the blow-pipe, which should fit in the hole loosely, so that when the egg is "blown" the contents of the shell may escape around the end of the pipe. Hold the egg in the left hand, with the hole downward; insert the small end of the blow-pipe into the hole just drilled. It is often a good plan to force water into the shell through the blow-pipe, and after all the contents have been ejected to thoroughly rinse out the shell.

The drying is an important part of the proceeding; for this purpose the egg is usually placed in sand, bran or meal. Some authorities claim that this is wrong, as the substances are apt to cake around the hole, where they become damp from the moisture absorbed. I have often found it difficult to remove the caked meal without injuring the shell. A recent writer

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suggests setting the eggs, hole downward, upon a piece of blotting-paper or a soft cloth. The paper or cloth not only absorbs the moisture without sticking to the shell, but, being soft and yielding, the eggs may be rolled about with no fear of breaking, and they may be dried in this manner thoroughly, without rubbing off the color or destroying the "bloom" peculiar to nicely preserved specimens.

A cabinet of eggs is not only an interesting object, but if the owner has collected them himself, he must necessarily acquire an amount of scientific knowledge that will not only at once make him an authority upon ornithology, even among learned men, but at the same time put him ahead of all the boys in wood-craft.

Eggs may be kept in boxes filled with bran or cotton, or they may be gummed on cards and the name of the bird and date of the collection written underneath; but probably the best way is to keep them in a chest of shallow drawers made for the purpose.

As soon as an egg is collected, number it with a lead pencil, and under a duplicate figure in a note-book write the number of eggs that were in the nest, the date of the collection, name or supposed name of the bird, with any and all other remarks of interest.

Birds' Nests.

A collection of nests makes an ornamental and interesting addition to a cabinet, and some very curious nests may be found. The two-story nest of the summer yellowbird is always an addition, especially if both compartments contain eggs.

The summer yellowbirds, though confiding little creatures, are not readily duped or imposed upon. Their instinct is sufficiently near reason for them to detect the difference between their own little fragile, prettily marked, greenish-colored eggs and the great dark-colored ones the vagabond cow blackbird has surreptitiously smuggled into the cosy nest. The domestic

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little couple cling to the spot selected for their house and will not leave it; neither will they hatch the obnoxious eggs, which they are apparently unable to throw out; but the difficulty is soon surmounted, and so are the gratuitous eggs, for the yellowbirds proceed at once to cover up the cow blackbird's eggs, constructing a new nest on top of the old one, building a second story to their house.

Last summer Mr. Lang Gibson brought me one of these two-story nests which he found at Flushing, L. I.; the lower nest contained two cow blackbird's eggs, and the upper one three eggs of the summer yellowbird. Gibson watched the construction of the nest. Visiting it again after it was finished, he discovered the egg of a cow blackbird. Next day two of these eggs occupied the nest. Some time afterward, to his surprise he found the nest contained three eggs of the yellowbird and no signs of the existence of those deposited by the blackbird, but the nest had the appearance of being much taller than at first, and an examination disclosed it to be a two-story nest, the lower compartment containing two cow-birds' eggs, and the upper part three yellowbirds' eggs. Since writing the above, the same young collector presented me with another double nest. This time both nests were inhabited and contained eggs; the lower story is a meadow wren's nest with an entrance on one side, and the upper one is the nest of the red-winged or swamp blackbird. The eggs in both compartments were warm when discovered, which proves that they were fresh and that the old birds had not long been absent.

Preserving Nests.

Nests made of woollen fibres must be dusted with fine tobacco, snuff, or camphor, to keep the moths out. Nests made of sticks, straws, etc., will not be attacked by insects, and need no preparation to preserve them.

CHAPTER XIX.

HOW TO REAR WILD BIRDS.

Robins, Thrushes, Wrens, and other Small Birds.

Learn the habits of any creature, and give it a chance to follow them, and you will find but little difficulty in keeping it healthy in confinement.

It is a mistake to suppose that it is a sin to keep wild birds in confinement; for when their wants are understood and attended to with any degree of care, the little creatures soon learn to love their cage, and will, more than likely, return to it of their own free will, if by accident or design they are set at liberty. When you hear it said that it is impossible to domesticate this or that bird, remember that the staid old barn-yard fowl is descended from a bird as wild and shy as any that inhabits the far Western forests. You need not hesitate to attempt to rear and tame any bird that runs or flies, provided that you are thoroughly acquainted with its habits when in a wild state.

Care should be taken to observe the food with which the parent birds feed their young, and if the natural food is difficult to obtain, a healthy substitute can often be discovered by experiment. Do not try, however, to force a young bird to eat that which appears distasteful to it, nor must it be forced to eat when not hungry. The feathered babies, as a rule, are very greedy, and will open wide their mouths as soon as they hear

any one approach, so that it is only necessary to drop the food between the widespread bills as often as they are opened.

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Squabs.

Doves and pigeons, when young, do not open their mouths like other birds, but they will keep their bills firmly closed and run them between your fingers, flapping their wings and making a whistling noise.

To feed a squab, its mouth must be opened by taking the sides of the bill between the thumb and forefinger of the left hand, and gently pinching it at the base until the mouth opens; then push an oblong pellet of bread softened with milk between the mandibles. You will always be successful in rearing squabs in this manner. Bread softened with sweet milk, or boiled potatoes mixed with eggs, is a healthy diet for many young birds.

The prepared food sold at bird-stores under the name of mocking-bird food I have discovered to be almost universally relished by insectivorous birds after they are old enough to feed themselves. As soon as a young bird can hop around, supply it with plenty of water to bathe in, at least once or twice a day; if you keep your pet's surroundings neat, the bird will not fail to keep its little person tidy and trim. The ground or grass finch will not bathe in water, but performs his ablutions in dust or fine sand, and a supply of sand should be provided.

The Cow Blackbird.

There is often a third party interested in the construction of all small birds' nests—a homeless, happy-go-lucky Bohemian bird, who has a sort of tramp's interest in the housekeeping arrangements of most of the smaller feathered denizens of copse and wood. This is the well-known cow blackbird, who disdains to shackle her freedom with the care of a family, and shifts a mother's responsibility by farming her progeny out, while she seeks the incongruous but apparently congenial com-

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panionship of the cattle, with whom she appears to be on the most intimate terms.

The cow-bird deposits its eggs indiscriminately among the nests of smaller birds. The blackbird's eggs generally hatch out a day or two before the adopted mother's own eggs, so when the legitimate members of the family do come, it is to find their nest already occupied by the strong, lusty interlopers, who, on account of their superior size and strength, come in for the lion's share of all the food brought to the nest. Thus the innocent parents rear the aliens, while their own young starve. It is really a pitiable sight to see a couple of little greenlets anxiously searching from daybreak till evening for food to fill the capacious crop of one or more young cow blackbirds considerably larger than the greenlets themselves.

As might be expected, the young cow-bird is an inveterate gormandizer, and you cannot supply it with enough food to stop its cries for more. True to its instinct, when its crop is crammed to its utmost extent, the young pauper will still cry for more and open wide its mouth, for fear its foster brothers and sisters should receive some share of the food. The blackbird wastes all it cannot eat, deliberately throwing the food away by a sudden jerk of the head.

Wrens, Sparrows, and Finches.

Feed young wrens, sparrows, and finches upon chopped worms and the soft parts of grasshoppers. As soon as their bills become hard enough the finches and sparrows may be fed upon bird seed that can be procured at any bird store.

The Bobolink.

Feed young bobolinks upon the soft parts of grasshoppers, and as they grow older and become inclined to corpulency, do not let them have too much to eat, or they will kill themselves.

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The Catbird.

The catbird resembles the mocking-bird so closely in its habits that it may be reared upon exactly the same food. I have made several successful attempts at rearing catbirds, and find them amusing and lively pets. One bird, that bore the name of "Greedy," would when called fly from the top of the tallest tree and alight upon my head or shoulder. The catbird will attempt to mimic almost every sound it hears. There is at present a couple of these birds which have a nest near my window. Here they build year after year, they have become quite tame, and the male bird has learned the first two notes of a bugle-call; it is very amusing to hear him struggle to master the rest of the call. When I whistle it to him, he sits on his favorite perch, a low limb of a peach-tree, and holding his head to one side, patiently waits until the call is finished; then filling his lungs, he gives the first two notes with remarkable clearness, hesitates a moment as if undecided what to do next, and ends in a wild burst of song. Often the bird will practise in a low key for ten minutes at a time, but as soon as he sees that he is observed, he will commence the scolding cat-cry from which these birds derive their name. The catbird or black-capped thrush requires a large cage and plenty of water for bathing purposes. A food preparation, published first, I think, in *Harper's Bazar*, consists of two-fifths pounded cracker, two-fifths oatmeal, and one-fifth hard-boiled egg; to be thoroughly mixed with equal proportions of milk and water until it is of the consistency of fresh bread.

Robins

are as easily domesticated as the catbird, and can be fed upon almost the same food. Fruit in season is always relished by Bob, and he will kill himself eating it if the quantity is not re-

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stricted. A robin that the writer once owned would eat a large slice of watermelon down to the green rind in a single day. Feed the young birds upon the soft parts of the grasshopper, white grub worms, and chopped angle-worms, or if such food cannot be obtained, use the yolk of hard-boiled eggs mixed with stale wheat bread made into a paste with a little milk or water. When the bird grows older the following preparation may be given: One-third stale wheat bread well soaked in water and pressed, one-third dry grated carrot, one-sixth of hard-boiled egg, and one-sixth of bruised hemp-seed. Mix well into a paste.

Robins will acquire a taste for many dishes which in their wild state they could never have eaten. One bird described by a writer in the *Science News* became very fond of hot doughnuts and other equally strange diet.

The Brown Thrush, or Thrasher.

Every country boy is familiar with "the long-tailed thrush," as they call this bird, and all of them know what a graceful bird he is, while, strange to say, but few know that he is an excellent song bird, little inferior to the mocking-bird in that respect. The brown thrush makes a good cage bird, and can be reared and kept upon the same food as that just described for the robin; their nests are generally found in low bushes among the thickets skirting cultivated ground.

The Wood Thrush

is of a bright brown upon the back, with a light speckled breast and a much shorter tail than the thrasher. Why this bird is called the wood thrush, is a question; around Flushing, L. I., it is seldom, if ever, seen in the woods proper, but in the ornamental trees on the lawns and the shade trees in the

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streets of the village this bird makes his home. His song, though rich and full, is short. The wood thrush is easily kept in captivity, and makes a valuable addition to an aviary. The young may be reared upon the same food as that described for the catbird.

Bluebirds

are pretty little creatures, making their appearance in the early spring. They build their nests in hollow trees, knot-holes, or bird-houses erected for that purpose, and have been known to build in a dove-cot, but since the introduction of that noisy little street gamin, the English sparrow, the bluebirds have mostly deserted the immediate neighborhood of the dwellings, and may be found in the orchards and other safe retreats. The bluebird makes an excellent pet, is of a lovable disposition, and will not associate with other birds except of its own kind.

Use about the same food as that described for robins.

The Summer Yellowbird.

While the expanding leaves of tree and shrub retain the tender tints of pink, and the broad lily-pads commence to mosaic the surface of the ponds with green, in perfect harmony with the bursting bud and opening flower comes the summer yellowbird, and from hedge and bush may be heard his song, as simple and pleasing as the tasteful but modest plumage that covers his little person. Almost immediately after the first appearance of these industrious little birds they commence their preparations for housekeeping. The male bird flies busily about selecting such material as feathers, plants, fibres, the furze from ferns, the catkins from willows, and other similar objects, all of which he brings to his mate, who arranges and fashions their delicate nest. So quickly and deftly does this little

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couple labor that they build the greater part of their house in a single day.

The author has never attempted to rear the summer yellowbird, nor has he ever seen one in confinement; but there is no reason why this beautiful warbler should not make as good a cage-bird as any other feathered songster. You may feed the young upon the soft parts of grasshoppers and soft grubs. This much can be learned by watching the parent birds attending to the wants of their tiny offspring.

The Bluejay

is a noisy, showy bird of brilliant plumage, with a pretty crest upon its head; the bill is black; the back and wings different shades of blue, with black stripes; throat, cheeks, and breast light gray; a black ring around his neck extends like a collar down to his chest.

Although the jay is no musician he is an excellent mimic, and can be taught to crow like a cock, bark like a dog, and to whistle a tune; he is a large, handsome bird, and looks well in a cage. The only young one the writer ever had was one that had just left its nest. It was caught in an orchard, and thrived upon grubs and worms of all sorts. Either the food described for the robin or the catbird ought to answer also for the blue-jay; an occasional spoonful of raw egg is relished by a young jay.

Want of space will prevent the enumeration of all the feathered creatures that make their home in our forests and orchards; but this chapter will be incomplete if it contains no mention of that most lovely of all American birds, the little feathered mite called a

Humming-Bird.

Even if captured when full grown, this delicate little creature can be tamed in a remarkably short time.

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Although the writer has been fortunate enough to find several little bunches of the cotton-like substance which forms the nest of the humming-bird, he has captured but one young bird; that one was discovered disconsolately peeping as it sat upon a smooth stone in the middle of a Kentucky stream. Upon the overhanging branch of a button-wood tree there was a little lump which was at once recognized as a humming-bird's nest, but so closely did it approach the branch in texture and color, that it might have been passed by unobserved had it not been for the otherwise unaccountable appearance of the little feathered midget upon the stone directly under it. The young bird, when picked up, did not offer to fly, but opened its long, slender bill and made a peeping noise, eagerly swallowing some little insects that were put into its mouth. It was not long before the parent birds commenced buzzing around the author's head like enraged bumble-bees; they even flew against his face, nor did they leave him until he had set their offspring free.

A writer in *Chambers's Journal* upon this subject says:

"It was long thought that humming-birds would not live in confinement; and this idea is so far correct that, although easily tamed, they will not live long in captivity if fed only on syrup. If confined to this food they die in a month or two, apparently starved; whereas, if kept in a small room, the windows of which are covered with fine net, so as to allow insects to enter, they may be preserved for a considerable time in health and beauty. Their nests are very curious; many of them are cup-shaped and very small, sometimes no larger than the half of a walnut shell; and they are often beautifully decorated on the outside with lichens, so as exactly to resemble the branch in the fork of which they are placed. They are formed of cottony substances, and are lined inside with fibres as fine and soft as silk. The nests of other species are hammock-shaped, and are suspended to creepers; the Pichincha hum-

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ming-bird has been known to attach its nest to a straw-rope hanging in a shed; their eggs are white, and they never lay more than one or two. Once, when on the Amazon, Mr. Wallace had a nest of young humming-birds brought to him, which he tried to feed on syrup, supposing that they would be

fed on honey by their parents. To his surprise, however, they not only would not swallow the liquid, but nearly choked themselves in their efforts to eject it. He then caught some very small flies, and dropped one into the wide-open mouth of the poor little orphan humming-bird; it closed instantly with a satisfied gulp, and opened again for more. The little creatures, he found, demanded fifteen or twenty flies each in succession before they were satisfied; and the process of feeding and fly-catching together required so much time that he was reluctantly compelled to abandon them to their fate."

The Illustration has been drawn by the writer from a compound yellowbird's nest. The upper story or nest is partly lifted so as to show the cow blackbird's eggs in the nest below.



CHAPTER XX.

HOW TO REAR WILD BIRDS—Continued.

The Crow, Hawk, and other Large Birds.



"I want my Ma!"

A FUZZY topknot surmounting a head too heavy for the slender neck to hold upright; large, protruding eyes protected by lids that are tightly gummed together; a bluish black skin, with no feathers to hide the wrinkles; a large paunch like an alderman. Such is the appearance of a very young crow; and after a glance at the accompanying sketch, drawn from

nature, the reader will no doubt agree with the writer in calling it the worst looking "baby in the woods," and if mischief be a sign of badness, then "Jim Crow" does not belie his looks. He is especially comical when his great blood-red mouth is expanded to its utmost dimension in expectancy as he awaits a morsel of food.

Of all our native birds the crow is probably the hardiest, and the least trouble to bring up by hand. Almost any kind

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of soft food, bread and milk, corn meal mush, grub worms, raw lean meat, or raw liver is devoured with relish by the black baby; any of the foods described in the preceding chapter may be fed to the crow. As soon as he is able to walk "Jim" will begin to learn to eat without help. The feathers will by this

time have grown, covering the body with a suit of glossy black, which gives the bird a very genteel and respectable appearance. The crow ought never to be confined in a cage, but allowed to wander around at will.

The first crow that came into the author's possession had scarcely escaped from its egg-shell prison before it was taken from the cradle of rough sticks that the parent birds had built near the top of a pine tree.

The bird was christened Billy, and from morn until night the neighbors could hear him as he loudly clamored for food. Before school-time in the morning an egg was broken and the contents of the shell dropped into William's great red mouth; with a gobbling noise the egg would be swallowed; then as if satisfied for the present he would settle down for a nap. During the noonday recess, Billy, with his red mouth wide open, was always loudly calling for his noontime meal, which consisted of the same material as his breakfast and supper. Three eggs a day kept the little black rascal fat and healthy, and it was not long before the naked little body was covered with a coating of glossy black feathers, and Billy, abandoning the old basket which had served him for a nest, now awaited his master's return from school, perched upon the iron railing fence of the front yard. From eggs to fresh liver was an easy step, and one that the bird gladly took. Corn he never ate unless it was in the form of "Johnny-cake" or mush; stale meat was his detestation; in fact, a cleaner or more dainty bird in regard to his food was never reared. Billy was not long in making a name and reputation for himself; a more affectionate and mischievous imp never

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wore a coat of black or buried silver thimbles in a flower bed. Although his pranks were often very annoying, they were always amusing, and no one ever thought the less of the bird for stealing all the fish from the miniature pond, nor did his master's anger, though great, cause him to administer severe punishment to the black culprit when he discovered the fish all neatly stowed away under the shingles of the rabbit house. When the young rabbits were discovered nicely pressed between the leaves of some books of travel just purchased, the gentleman to whom the books belonged declared war. He went to the lawn to search for Billy, and the bird flew to him, and, alighting upon his shoulder in the most fearless and confident manner, commenced a long explanation of his misdeeds in the crow language. What he said was unintelligible; but the gentleman's anger was not only mollified but changed to mirth, for he came back to the house laughing heartily. Billy, still perching upon his shoulders, seemingly enjoyed the situation.

Since the writer's first experiment he has brought up several other crows successfully upon a diet of fresh meat, bread and milk, and boiled potatoes mixed with eggs.



Strap for Hawk's Leg.

The Hawk.

Naturally possessed of a wild, fierce nature, loving the open air and the wide, blue sky, the hawk is a born freebooter; but wild and fierce as he is, he may nevertheless be perfectly tamed if taken from the nest when quite young.

After you have obtained a young hawk, make it a rule to always feed it yourself and never allow any one else to do so. Give a peculiar whistle (in the same manner) each time

you feed it, and the bird will learn to know the signal and come

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at the call. Keep the hawk in your company as much as possible, and when you can, set its perch where it will see the people around the house, and become accustomed to their presence; by this means the bird may be taught not to fear man, and it will soon become as harmless as any small cage-bird.

Feed young hawks upon fresh lean meat of any kind. When they grow older they develop a fondness for rats, mice, and small birds. Do not trouble yourself about their drinking-water, as they do not need it.

The Hawk as a "Scare-crow."

A tame hawk is very useful in keeping the chickens out of the garden. Whenever the writer has placed the perch with his pet hawk upon it in the garden, not a chicken has dared to enter the enclosure; they all seem to know their enemy by instinct, and give it a wide berth.

The hawk himself seems to know when he is doing guard duty, and will sit as motionless as a statue, his head sunk down upon his shoulders, but the keen, bright eyes survey the whole field, and not an object moves that they do not see.

The Hawk as a Decoy.

If you want to trap other birds a tame hawk is a very valuable assistant. At any convenient spot set your bird traps, near by fasten the hawk, and retire a little distance; it will not be many minutes before the small birds will discover their dreaded enemy, and from bush and tree the spunky little feathered warriors will come to give battle. In a few moments the ground and air around the hawk will be filled with robins, cat-birds, blackbirds, sparrows, yellowbirds, thrushes, wrens, and even the tiny humming-bird, making up in grit what he lacks in size, will join the other birds in their war against a common foe. In the confusion and bustle that ensues some of the

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small birds are sure to enter a trap or become entangled in a snare, and must be removed before they injure themselves in struggling to regain their freedom. As soon as you retire a little distance the small birds will again commence their war upon the pet hawk, who is thoroughly competent to take care of himself, so you can devote your whole attention to your traps. As a pet the hawk is a pretty bird, and always charms spectators by his bold, military bearing and his bright, clear eyes.

Owls

the author has found inclined to be more wild and untamable than hawks and not so interesting. Even the little screech-owls are vicious and treacherous, snapping their small bills in a savage way whenever they are approached. A friend sends word that he has been more successful, and has even succeeded in taming the great Virginia horned owl, which was allowed to fly around with perfect freedom. "Bubo" would fly all over the village but return at meal times; he would come at a call and knew his master, obeying him even to the extent of letting go his hold of a pet bobolink when commanded to do so. The bobolink, though a little bruised, was otherwise unhurt, and soon recovered from the effects of being caught in the dreaded talons of "Bubo."

Sea Birds.

Any of the guillemot tribe will do well if kept in an en-

closure where there is room for them to run about. The author has seen numbers of tame sea birds, although he never attempted to rear one himself, and would advise the reader not to try unless he has plenty of room. Sea birds are strange creatures, and their characteristics are so well portrayed by a writer for *The London Field* that part of the amusing article is here given in the writer's own words:

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"I have been forced to banish a couple of herring gulls, as they persist in tearing up the grass by the roots. Some few years back I had a third of the same species, named 'Sims Reeves' (all the birds are named, so that I can give directions for special treatment to any particular individual during my absence); but he asserted his authority over the other two, 'Moody' and 'Sankey,' in such an overbearing manner—driving them round and round the pond, the two poor wretches meekly trotting in front of him, while he every now and then gave vent to the most melancholy and piercing screams—that, as I found they would not live peaceably together, Sims Reeves was allowed to go with his wing unclipped, and in due course took his departure. No sooner had he gone than Moody at once became 'boss,' and the last state of poor Sankey was no better than the first. At times they were quiet and contented enough; resting side by side on the grass, they appeared to be the best of friends. Without the slightest warning, however, Moody would arise, and when he had cleared his throat by a preliminary 'caterwaul,' the submissive Sankey, having learned by experience that it would not do to be caught, would be up and off. Then, with his head drawn back between his shoulders and his feathers slightly puffed out, Moody would follow in his wake. For an hour or so this mournful procession, round and round the pond, would continue. At last Moody would stop, Sankey also pulling up at the distance of a yard or two. Moody leading, they would then commence a duet *à la* tomcat, when, suddenly dropping on their breasts on the ground, they would turn rapidly round several times, and at last attack the grass in the most excited manner, tearing it up by the roots and scattering the fragments in every direction. This proceeding is accompanied by the most melancholy cries and screams, and when it is stated that the voice of Grimalkin in his happiest, or rather his unhappiest

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moods, is almost sweet and pleasing to the ear compared with the discordant wailing of these infatuated birds, one may judge of the nature of their performance. Whether these antics are intended for courtship or defiance I am perfectly ignorant, but I have observed pewits acting in much the same manner. At first I imagined the bird was forming its nest (I was in a punt at about ten yards' distance), but on examining the spot on the following day I found no marks, and then came to the conclusion that the bird was either showing himself off for the admiration of the female, who was close by, or else bidding defiance to another male, which I could plainly see indulging in the same performance at a short distance. I have not the slightest doubt that gulls, and every species of sea bird, might, with proper attention and food, be so thoroughly reconciled to confinement that they would nest and rear their young."

Strange Domestic Fowls.

In a small town situated in the interior of Georgia there lives a queer sort of sporting character, who has, or did

have a few years ago, the strangest collection of fowls in his chicken-yard that it has ever been my fortune to see. I was strolling along a side street in the town when my attention was attracted by the sight of a large black bear chained to the door-post of a small frame tavern. While watching the huge beast, I was accosted by the proprietor, and invited into the barn-yard to see his "chickens," which he was about to feed. The invitation was accepted. At the first call of chick! chick! there came flying and running a curious assortment of fowls, tumbling over each other in their greedy haste. There were ducks, geese, and chickens like those to be seen in any farm-yard, but mingled with these were wild geese, mud hens, partridges, and beautiful little wood ducks; the latter seemed tamer than the domestic species. Towering above all the other

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fowls, flapping his wings, and making a loud metallic noise, was a great long-legged, red-headed crane. I afterward learned that the wild geese and ducks had their wings clipped, for, although they may be perfectly tame, these birds are very liable to fly away in the autumn when they see or hear their wild "cousins" and their "aunts" flying overhead. I give this little experience to show the boys that any bird may be domesticated if its habits and wants are understood; of course, it is always best to take young birds for the purpose.



CHAPTER XXI.

HOME-MADE HUNTING APPARATUS, ETC.

Spearing Fish.

"I DON'T know! Shure I *never* tried," is the answer reported to have been made by an Irishman, when asked if he could play the fiddle. No doubt there are many boys who would give a like reply if asked if they could spear a fish.

An amateur's first attempt at casting a spear will probably meet with about the same success as "Paddy" might be expected to achieve in his first trial of a fiddle; but almost anything can be accomplished by practice. The keen enjoyment of the fisher who by his skill and dexterity has succeeded in striking a fine fish, can only be compared to the pleasant triumph of his brother sportsman in the field who has just secured two birds by a difficult double-shot.

How to Make a Fish Spear.

Make the shaft or handle of any straight stick or pole seven or eight feet long; trim it down, and test the weight occasionally by balancing it in the hand. When the shaft seems to be

about the proper weight, it should be let alone, and attention directed to the barbs for the head of the spear.

In place of the ordinary single point generally used as a spear head, the fishing spear may be supplied with two points, as shown in the illustration (Fig. 121, p. 189). Any hard, elastic material will do for the head, split bamboo or cane, two pieces of heavy iron wire, filed to a point and notched into barbs upon the

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inside, as shown in the diagram, or the points may be made of bone like the fish arrows used by the inhabitants of Vancouver's Island. Very hard wood will also answer for the spear head. After the head pieces are notched and pointed, they should be firmly bound to the spear at a point a few inches below the end of the shaft. A couple of small wedges driven in between the shaft and the points will diverge the latter, as in the illustration. After this is accomplished, lash the barbs firmly on up to the head of the shaft. If a fish be struck by one of these weapons, it will be next to impossible for it to escape. The elastic points at first suddenly spread apart as the spear strikes the fish's body; the next instant they violently contract, holding the fish a secure prisoner. The barbs upon the inside prevent the prey from slipping out, no matter how smooth and slimy his body may be.

A small instrument made upon a similar plan can be used for catching snakes or other reptiles that are not safe or pleasant to handle. Frogs may also be readily captured with a fish spear, and any boy who takes the time to make one of these weapons will find himself amply repaid for his trouble. The elder stick described and illustrated upon page 34 is made upon the same principle as the fish spear.

Armed with fish spears and torches great fun can be had spearing fish from a row-boat at night. The torch illuminates the water and appears to dazzle the fish, at the same time disclosing their whereabouts to the occupants of the boat, who with poised spears await a favorable opportunity to strike the scaly game.

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How to Make the Torches and Jack-Lights.

One way to make a torch is to wind lamp-wick upon a forked stick (Fig. 122). The ball of wick must be thoroughly saturated with burning fluid of some kind. The torches should all be prepared before starting upon the excursion.

Never take a supply of kerosene or any explosive oil with you in the boat, for, in the excitement of the sport, accidents of the most serious nature may happen. A safe light can be made with a number of candles set in a box. A glass front allows the light to shine through, and a piece of bright tin for a reflector behind adds brilliancy to the illumination. A box of this description is generally called a "jack-box;" it is much less trouble than the flaring pine-knot or wick-ball torches.

The candles in the "jack-box" should be replenished each time after it is used; in this manner the jack may be kept always ready for use. After the candles are lighted fasten the box in the bow of the boat; here it will throw a bright light ahead, illumi-



FIG. 122.—Wick-torch.

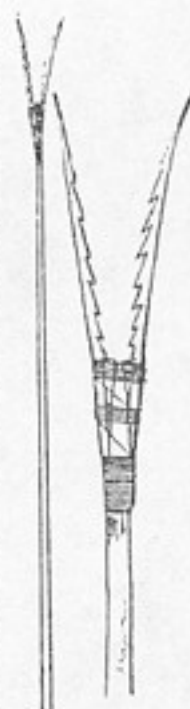


FIG. 121.—Fish Spear and Enlarged View of Spear Head.

nating the water, but casting a heavy, dark shadow in the boat, concealing the occupants from view. The boys in the boat can, of course, see all the better for being themselves in shadow.

The Boomerang.

We might expect strange weapons to come from a land that produces quadrupeds with heads like ducks, and other great beasts that go bounding over the plains like some immense species of jumping spiders, using their thick tails as a sort of spring to help them in leaping, and carrying their young in their fur-lined vest pockets! Nor will we be disappointed when, after viewing the duckbill and the kangaroo, we see the odd-looking clubs called boomerangs, or the simple but in-

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genious throw-sticks by means of which the native Australians are enabled to cast their weapon, with the greatest accuracy, an astonishingly long distance.

The boomerang, or bommerang as it is sometimes called, is one of the most mysterious weapons known. Evolved by slow degrees from a simple war club by the ignorant and savage Australians, this instrument excites the interest and astonishes the civilized man by its strange and apparently unaccountable properties. To all appearances it is a simple, roughly hewn club, yet its movements when thrown by an expert hand are so eccentric as to make it a curious anomaly even to persons educated in natural philosophy. Whatever is wonderful or marvellous is always a subject of peculiar interest to mankind generally, but to boys an inexplicable natural phenomenon is a treasure-trove of immeasurable value.

How to Make a Boomerang.

With boiling water scald a piece of well-seasoned elm, ash, or hickory plank that is free from knots. Allow the wood to remain in the water until it becomes pliable enough to bend into the form indicated by Fig. 123. When it has assumed the proper curve, nail on the side pieces A, A (Fig. 123) to hold the wood in position until it is thoroughly dry; after which the side pieces may be removed, with no fear that the plank will not retain the curve imparted.

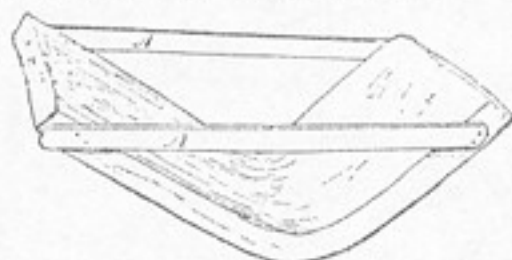


FIG. 123.

Saw the wood into as many pieces as it will allow (Fig. 124 B), and each piece will be a boomerang in the rough that only

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needs to be trimmed up with a pocket-knife, and scraped smooth with a piece of broken glass to make it a finished weapon.

A large wood-rasp or file is of great assistance in shaping the implement. Fig. 124 C shows a finished boomerang. Fig.

124 D shows a cross section of the same. The curve in no two boomerangs is exactly the same; some come round with a graceful sweep, while others bend so suddenly in the middle that they have more the appearance of angles than curves. Just what the qual-



FIG. 124.

ity is that makes a good boomerang is hard to discover, although, as a rule, the one that appears to have the best balance and feels as if it might be thrown easily is the best.

To Throw a Boomerang.

grasp the weapon near one end and hold it as you would a club;

be careful to have the concave side, or hollow curvature, turned from you and the convex side toward you. Take aim at a stone, tuft of grass or other object on the ground about a hundred yards in front of you, and throw the weapon at the object. The weapon will in all probability not go anywhere near the mark, but, soaring aloft, perform some of the most extraordinary manœuvres, then starting off again with apparently renewed velocity, either return to the spot from where it was thrown or go sailing off over the fields like a thing possessed of life. A boomerang cast by a beginner is very dangerous in a crowd, for there is no telling where it is going to alight, and

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when it does come down it sometimes comes with force enough to cut a small dog almost in two.* Select a large open field where the ground is soft and there is no one around to be hurt. In such a field you may amuse yourself by the day throwing these curious weapons, and you can in this manner learn how to make the boomerang go through all manner of the most indescribable movements seemingly at your bidding.

The Miniature Boomerang

here represented is supposed to be cut out of a card. The shape given in the illustration is a very good one, but it may be varied to an almost unlimited degree. Card boomerangs over an inch or so in length do not work well, but they may be made very much smaller.

One of these tiny instruments cannot be grasped by the hand, but when it is to be launched upon its eccentric journey the toy should be laid flat upon a card, allowing one end to project from the side as in Fig. 125. Take hold of the lower left hand corner of the card with the left hand, and with the forefinger of the right hand fling the boomerang, striking it a quick, smart blow with the finger-nail, and the little missile will sail away, going through almost the same manœuvres that the large wooden boomerang does when thrown from



FIG. 125.—Miniature Boomerang.

the hand. Small boomerangs can be whittled out of a shingle with a pocket knife, and considerable amusement had with them; these small affairs can be thrown on the crowded playground, where it would be exceedingly dangerous to experiment with the larger and heavier club before described.

* "I have seen a dog killed on the spot, its body being nearly cut in two by the boomerang as it fell."—Rev. J. G. Wood.

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The Whip-Bow.

This graceful and powerful weapon is like an ordinary long-bow, with the exception that the bow-string is made fast to but one end, after the manner of a whip-lash; where the whip-lash

terminates in a "snapper," the bow-string ends in a hard, round knot (Fig. 126); the arrow is made like any other arrow, either with a blunt end or a pointed spear-point. In one side of the arrow a notch is cut (Fig. 126, A); the bow-string being slipped into this notch, the knot at



Position Assumed when Casting the Arrow.

the end of the string prevents the arrow from slipping off until thrown by the archer, who, taking the butt of the whip-bow in his right hand, holds the arrow at the notch with his left hand, as in the illustration; then swaying his body from side to side, he suddenly lets go with his left hand, at the same time extending his right arm to its full length from his side; this not only gives the arrow all the velocity it would acquire from the bow, but adds the additional force of a sling, thus sending the projectile a greater distance. The only place that I have seen the whip-bow used is on the lake shore in North-

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ern Ohio. In some parts of this section it used to be a great favorite among the boys, who would throw the arrows up perpendicularly an amazing distance. Arrows can be bought in any city, but most boys prefer to make their own, leaving the "store arrows" for the girls to use with their pretty "store bows." The essential quality in an arrow is straightness. A spear-head can be made of an old piece of hoop-iron, a broken blade of a knife, or any similar piece of iron or steel, by grinding it down to the proper form and then binding it on to the shaft with fish line, silk, or a "waxed end," such as shoemakers use, or the arrow may have a blunt end with a sharp-pointed nail in the head. These arrows should only be used in target practice or when after game; they are dangerous on the play-ground. A simple whip-bow may be made by any boy in a few minutes out of an elastic sapling or branch, and an arrow cut out of a pine shingle with a pocket-knife. This can be improved upon as much as may be desired by substituting a piece of straight-grained, well-seasoned wood for the green branch, and regularly made Indian arrows for the crude pine ones.

Throw-Sticks.



FIG. 126.—Whip Bow.

The same race that invented the wonderful boomerang also originated the equally ingenious throw-stick illustrated by Fig. 127, page 196. Although any of my readers can, in a few moments, fashion a throw-stick from a piece of wood by the aid of a pocket-knife, I doubt if they could use the instrument to any advantage without considerable practice.

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Make the lance of cane or bamboo; use a straight piece and put an arrow-head upon one end; then holding the lance on a throw-stick, as shown by the accompanying illustration, cast it with all your might. The first trials will, doubtless, be failures, but nothing is gained without practice; and when you once "catch the hang of the thing" you will be astonished to see what a distance a comparatively small boy can throw a spear. Any straight, thin stick may be used as a lance. Allow one end to rest against the point upon the throw-stick, which will hold it in place until the cast is made. The throw-stick acts as a sling, lending additional force to the arm, and sending the spear much further than the strongest man can cast it with his unaided hand.



FIG. 127.—Throw-Sticks.

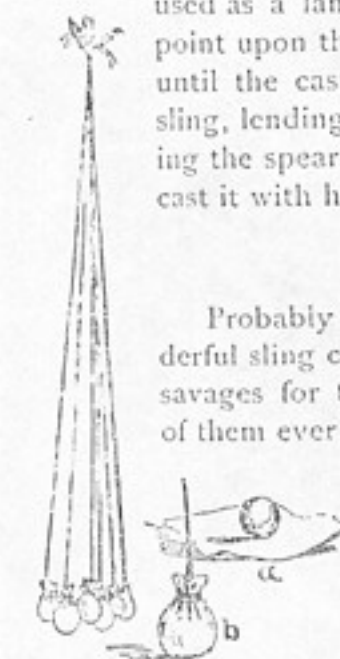


FIG. 128.—Bird-Bolas.

The Bird-Bolas.

Probably all of my readers have read of that wonderful sling called a "bolas," used by some tribes of savages for the capture of game, but I doubt if any of them ever tried to manufacture one for themselves.

Yet this curious missile can be made by a boy, and if he be inclined to field sports, he will find that a bird-bolas will do considerable execution.

Hunt for a half dozen round stones about the size of large marbles, or, better still, take six leaden musket-balls, wrap each ball in a piece of an old kid glove, buckskin, or

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cloth, as shown by the diagram (a, b, Fig. 128). Take three pieces of string each five feet long, double them in the centre, and bind the doubled parts together; a few small feathers may be bound in to add a finished and Indian look to the bolas. To the ends of the strings attach the bullets (Fig. 128). To cast the bolas, grasp it by the feathered part with the thumb and first finger, whirl it around your head as you would an ordinary sling. When you let go, the loaded ends of the strings will fly apart, so that the missile will cover a space in

the air of five feet in diameter. If a string strike a bird it will instantly wrap itself round and round the body; if the loaded end strike the game it will, of course, stun or disable it. One of these instruments cast into a flock of birds is certain to bring down several.

For target practice, use in the place of the ordinary butt a number of reeds or sticks stuck upright in the ground about a foot apart; after measuring the distance for the marksman to stand and marking the spot, let him see how many reeds he can level at a single cast of the bolas. The one who makes the biggest score can assume the title of "Big Injun," and wear a feather in his hat, or an appropriate badge, until some more skilled hand beats the record and wins the title and the badge. No shots should count unless made in a regularly appointed match.

The Elastic Cross-Bow.

(A NEW KIND OF CROSS-BOW.)

Select a piece of thick pine or cedar plank and saw out a piece of the form shown by A, Fig. 129. Trim it down with a jack-knife until it becomes more finished and gun-like in appearance. With a gouge, such as may be borrowed at any carpenter or cabinet-maker's shop, cut a half round groove from

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the butt to the muzzle of the barrel. The groove must be perfectly straight and true (B, Fig. 129). Bore a hole in the piece (E), for the bow to fit in. The bow in this case should be made perfectly stiff, so as not to bend in the least when the line is drawn and the gun set. The bow may be bent into the proper form by steeping it in boiling water until the wood becomes pliable, and binding it firmly into the required position. After it

has become perfectly dry the wood will retain the form and the bindings may be cut off. Trim the bow nicely into shape, and make it of such size that it will *not bend* when the string is drawn. Fit the bow into place, not like an ordinary cross-bow but in a re-

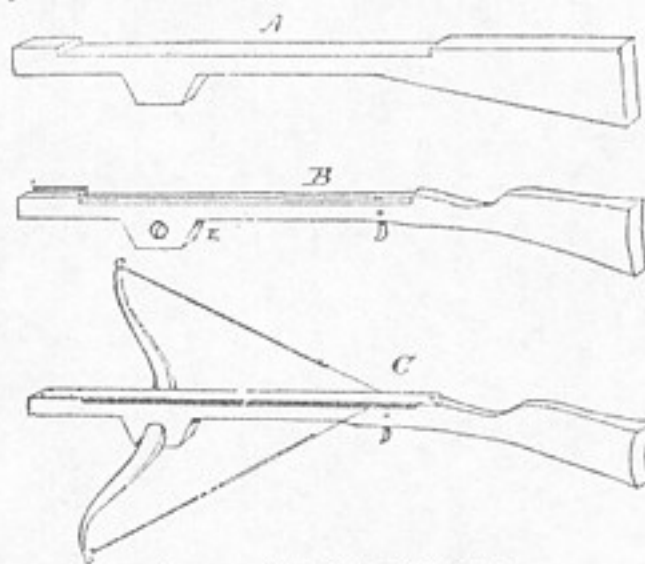


FIG. 129.—The Elastic Cross-Bow.

versed position, as shown by the diagram C, Fig. 129. It might be an improvement to set the bow back toward the stock an inch or two further than the one in the illustration. For a bow-line use two pieces of strong elastic, with a string for a centre piece. The centre cord prevents the bow-line from wearing out as soon as it would if it were all elastic (Fig. 129, C). Make the trigger in the manner described for the plunger pistol (Fig. 134, page 204), but instead of fastening it upon one side with a screw, set it in a slot cut for the purpose in the middle of the barrel near the stock, and let it move freely upon a pivot.

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Cut a thin, smooth piece of pine just long and wide enough to cover the gun-barrel from stock to muzzle, and fasten it on

with a couple of small brads at the muzzle and a screw at the stock (Fig. 129, C).

There is always a certain amount of danger attending the use of firearms which is avoided by the cross-bow, added to which advantage is the fact that the twang a bow-string makes is so slight a noise as not to alarm the game, and if the young sportsman be inexperienced he may shoot several times at the same bird or rabbit without frightening it away. With a little practice it is astonishing what precision of aim can be obtained with the cross-bow. I know boys who seldom miss a bird even with the simple elastic sling, consisting of two pieces of rubber bands attached to a forked or a straight stick (Fig. 130).



FIG. 130.—Elastic Sling.



Hunter's Cabin.

CHAPTER XXII.

HOW TO MAKE BLOW-GUNS, ELDER GUNS, ETC.

THE fierce and savage head hunters of Borneo go to war armed with the same implements with which the school-boys shoot peas or pellets of clay at unsuspecting citizens as they pass the ambuscade of tree or fence. The blow-guns used by the Dyaks of Borneo are called sumpitans, and instead of clay balls they carry poisoned arrows. A spear is also attached to the side of one end of the sumpitan, after the manner of a bayonet on a modern rifle. In speaking of the sumpitan a recent writer says: "This curious weapon is about eight feet in length and not quite an inch in diameter, and is bored with the greatest accuracy, a task that occupies a long time, the wood being very hard and the interior of the sumpitan smooth and even polished. It is not always made of the same wood. The surface is of equal thickness from end to end." Among the South American Indians the sumpitan is represented by the long delicate "pucuna," or the heavy and unwieldy "zarabatana." All savages use poisoned arrows in their blow-guns instead of harmless pellets of clay or putty. Taking a few hints from the primitive warriors and hunters of Borneo and South America, any boy, with a little care and small expense, can construct for himself a blow-gun which will be handy to carry around and will shoot with great accuracy. Mr. W. Hamilton Gibson, the well-known artist, has acquired such skill with the blow-gun that he seldom misses the mark, and often brings home

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birds and other creatures brought down by a clay pellet blown from a glass sumpitan.

For twenty-five cents a glass tube, three or four feet long, can

be purchased. With these tubes can be made the best of blow-guns, but they are objectionable on account of being liable to break at any moment from some accidental blow or jar. With some flannel or woollen cloth and an old piece of cane fishing-pole a cover and a case can be made to enclose the glass and prevent its being broken by anything short of a severe knock or fall.

To Make a Blow-Gun.

Select a good straight piece of glass tube about three or four feet long. To discover whether the glass tube is straight or not, hold it horizontally level with the eye and look through it, and any deviation will be quickly seen. Wrap the tube with strips of flannel or woollen cloth, as illustrated by Fig. 131, A. The

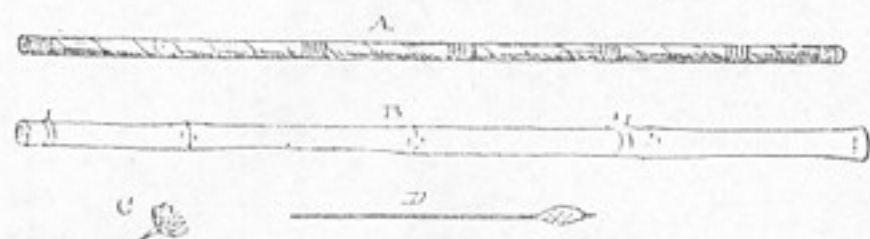


FIG. 131.—The Hunter's Blow-Gun.

cloth will make a soft covering or cushion for the outside of the glass and render it less liable to break. With a red-hot iron rod, or some similar instrument, enlarge the hollow in the centre of a piece of cane until the blow-gun can be slid inside the cane. With putty, shoemakers' wax or beeswax secure the tips of the tube in place. Trim off the ends of the cane until they are flush with the ends of the glass. You will then have a blow-gun that can be used to hunt with (B, Fig. 131). For missiles may be used arrows, tacks, peas, or clay. The arrows

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must be very small, and a pin with its head filed off makes a simple point; some raw cotton bound on the butt end to make it fit the inside of the gun finishes the missile (Fig. 131, D). The tack is prepared by fastening short pieces of worsted or carpet ravelings to it just below the head with shoemakers' or beeswax (C, Fig. 131).

This not only fills up the space inside the blow-gun, making it fit, but the yarn also acts as a feather does upon an arrow and causes the tack to fly straight and point foremost. The worsted-headed tack is a "tip-top" missile for target practice. The clay pellet will bring down small birds, stunning them, but doing them no serious injury, so that if the birds are quickly picked up they can be captured alive.

Along the Mississippi River, from New Orleans to Nashville, there are still some remnants of the Indians that in olden times paddled their canoes up and down the Father of Waters. The boys among these tribes make splendid blow-guns out of cane. When the inside is bored out they straighten the cane by heating it over hot coals, and then, after attaching a heavy weight to one end, suspending it by a string attached to the other end. The heat from the hot coals makes the cane pliable, and before it becomes cold and hard, the weights make it almost as straight and true as a rifle-barrel.

Squirt-Guns.

Some time during the summer of each year a boy used to appear with a squirt-gun made of a piece of cane. Squirt-gun-time then commenced, next day four or five guns might be seen on the play-grounds, and before a week had passed the curb-stone in front of the little frame school-house presented a line

of boys all busily engaged in seeing who could shoot the greatest distance; the dusty macadamized street registered every drop of water by a muddy spot. I found that by adding

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a quill as a nozzle to my "squirt" it would throw water much further than the others. It is a very simple thing to make a good squirt-gun, and one may be manufactured in a few minutes.

First cut a joint from a piece of an old cane fishing-pole, being careful not to disturb the pithy substance that almost closes the hollow at the joints. Insert a quill for a nozzle at one of the joints and see that it fits tightly; leave the other end open. With your pocket-knife fashion from a piece of pine or cedar the plunger (B, Fig. 132); leave the wood

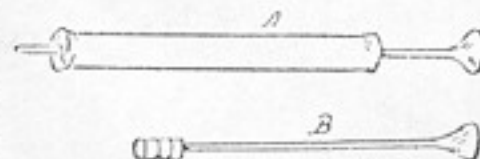


FIG. 132.—Cane Squirt-Gun.

a little thicker at both ends and wrap a rag around one end, making it just thick enough to fit snugly in the cane after wetting it. This completes the "squirt" (A, Fig. 132). To use it, immerse the quill in water, first push the plunger in, then draw it out slowly until the gun is filled with water. Take aim, and when you push the plunger back again the water will issue from the quill in a sudden stream, travelling quite a distance. One of these water-guns is quite useful in the garden; by its means the insects infesting the rose bushes and other shrubs may be knocked off in no time. When the owner of an aquarium finds dead animals or plants that should be removed, located in some crack or cranny that is difficult to reach, the squirt-gun is just the thing to dislodge the objects without disturbing the surrounding rocks or plants.

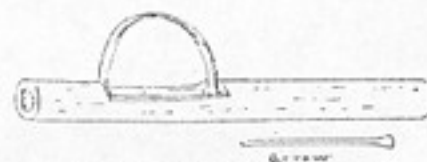


FIG. 133.—A Simple Elder-Gun.

Elder-Guns and Pistols.

When the author was a very small boy he was taught by some playmates to make an elder gun, a simple contrivance, made of a piece of elder or any other hollow stick. A long

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notch cut in one side admits a spring made of whalebone (Fig. 133). By pushing the spring back the short arrow shown in the illustration can be propelled quite a distance. If instead of the awkward whalebone spring a piece of elastic be used, a

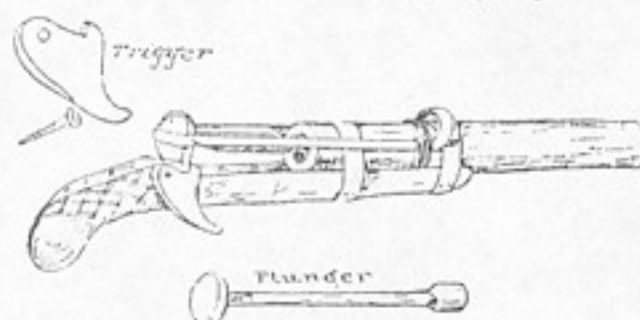


FIG. 134.—Plunger Pistol.

much neater gun can be made. Fig. 134 shows a pistol made with an elder barrel and a stock of pine. A plunger, similar in many respects to the one used in the squirt-gun, is made with an edge to catch in the trigger. An elastic band is bound to the barrel with string, and the loop fastened to the butt end of the plunger. When the latter is drawn back to the trigger it stretches the elastic. By pulling the trigger toward you it loosens the plunger, which flies back with a snap, sending the arrow out with considerable force. The barrel of the pistol may be fastened to the stock by two strips of tin or leather. The diagram shows the form of the trigger, which should

be made so as to move readily backward or forward upon the screw that fastens it to the stock.

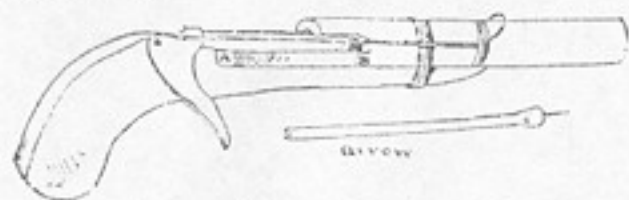


FIG. 135.—Pistol without a Plunger.

Fig. 135 shows how a pistol can be made to work without a plunger. In this case the barrel is partly cut off from A to B. The arrow should be made to fit in the groove, so that when the elastic is loosened it will strike the arrow in the same manner

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that the string of a cross-bow does. Both these pistols, if made with good, strong elastic, will shoot quite a distance, and if the arrows are armed with a tack or pin in the head they can be used in target practice. We now come to a gun in which the spring is the principal part.

The Spring Shot-Gun.

A certain old gentleman was at one time very much annoyed by fine bird-shot which at all times of the day came rattling against the window-panes of his study. Being somewhat of a philosopher, the old man at last became deeply interested in investigating the cause of his annoyance. From the window

he could see a house separated from his study by a deep back yard, a vacant lot, and another yard. While peering out between the blinds of his window he saw a boy appear at one of the windows of the distant house;



Spring Shot-gun.

the boy held something in his left hand which he pulled with his right; almost instantly there was a rattling of bird-shot against the old gentleman's window glass, and the boy disappeared. But so great was the distance that separated the two houses that it was impossible for the old man to distinguish what sort of an instrument the mischievous lad used to propel the fine shot so far and with such force. The youngster was at last waylaid, and the mystery solved. The machine used proved to be a spring shot-gun. No powder or explosive is used with one of these guns, neither does it possess stock, trigger, or sights, but simply consists of a stick of whalebone or any other

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elastic material, one end of which is armed with a large quill, corked at its lower end.

When the quill is filled with fine bird-shot and the end of the stick grasped by the left hand, the contents of the quill can be thrown an amazing distance by bending the quill end back and allowing it to suddenly fly forward, upon the principle of the whip bow. If instead of a small piece of whalebone a large and very elastic rod be used, with a tin tube in the place of the quill, an effective weapon will be produced useful for hunting and collecting purposes; although the shot cast from the tube will have sufficient force to stun a small bird, it will not injure the specimen by making ugly holes in the skin and staining the feathers with blood. All of the weapons described in this and other chapters should be used with care, for many of them are capable of inflicting severe wounds. Never aim a bended bow with arrow set at a companion or friend, for a little slip may

cause irreparable harm. Even a blunt arrow propelled from a barrel-hoop bow has sufficient force to destroy an eye or make a severe bruise. A true sportsman has the greatest respect for his weapons and handles them with scrupulous care.

Autumn.



CHAPTER XXIII.

TRAPS AND TRAPPINGS.

SUMMER is over. Again the air becomes cooler. The straw hats are discarded, so also are the linen suits; we begin to look up heavier clothing, for although the sun still shines brightly, the nights are growing chill. Even at midday we no longer seek the shady side of the streets or roadways.

In the woods all the little inhabitants are preparing for the approaching winter. Backward and forward, from the beech tree to his nest under the wood-pile, runs the nimble little brown-coated, striped-back chipmunk, each trip adding to the pile of beech nuts secreted in the storehouse of this provident little fellow. Scampering along the top rail of the fence the gray squirrel may be seen, also busily engaged in laying up a supply of winter stores. The birds are gathering in large flocks, with noisy twitterings and excited flutterings, preparatory to their yearly pilgrimage to the Sunny South. The bouncing hare is thinking of discarding its summer coat of brown and donning its white winter furs. The leaves of the ivy vines shine like red fire wreathed around the tree trunks. All nature seems busy going through a transformation scene—an air of preparation is visible everywhere.

The reports of the sportsmen's guns may be heard, and their dogs may be seen in the stubble-fields manœuvring like well-

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drilled soldiers promptly obeying every command of their masters.

And far and wide—in the cold Northern regions, in the pine woods of Maine, in the Rocky Mountains of the West—the

hardy trappers are busy collecting their traps and making preparations, or are already engaged in their annual campaign against all fur-bearing animals.

In order that my reader may not be behind the season, this chapter is devoted to the description of a few simple but effective traps and snares, such as may be made of the material always at hand, with the aid of a pocket-knife, hatchet, or other tools within the reach of boys.

Rats.

We have in North America more than fifty kinds of rats and mice, the largest of which is the muskrat. Next in size comes the great, ugly brown rat.

More than three hundred years ago the black rat found its way from Europe to this country, settled here with our ancestors, and, like them, increased and prospered. The black rat is rather a neater and prettier animal than the now omnipresent Norway brown rat. The latter is of Asiatic origin, and appears to have made its way to this country since the advent of the black rat, which it has supplanted and almost exterminated. The roof rat in the Southern States came originally from Egypt, and the little brown mouse that creates so much mischief in our closets is of Asiatic parentage. All rats may be caught in traps, and for an amateur trapper the house rat is a good subject to practice on. By no means a fool among animals, possessing a due regard for his own safety, and looking with suspicion upon most traps, the Norway brown rat is not so easily caught as one who has never baited a "figure four" might suppose. A very successful way to capture house rats

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is to carefully close all the doors of the kitchen, barn, or room infested with them, and after removing all small objects from the floor, bait each hole with crumbs of meal and cheese; over the holes place little doors made of tin or wire, hung on with strings or screw-eyes, these doors open but one way and are so arranged that the rat can easily push the door open from the inside, but as soon as the animal makes its appearance in the room the door falls back into place, thus cutting off all retreat. In a short time the room will be overrun with rats, and if allowed to remain undisturbed for a few hours they will all escape through new holes made by their sharp teeth; if a terrier dog or a few cats be let into the room, not many rats will live to tell the tale of the massacre.

The Paper Pitfall.

Over the top of an earthenware jar fasten a piece of writing

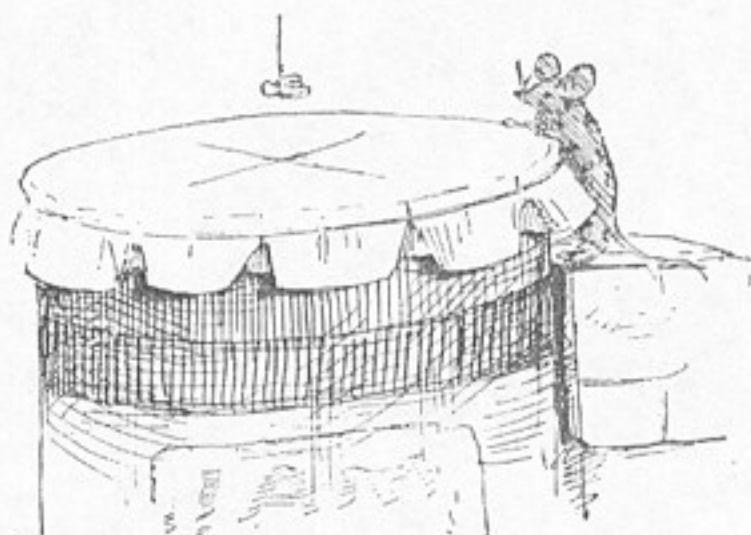


FIG. 136.—A Mouse Trap.

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paper, tightly binding it with a string or elastic band. In the centre of the paper cut a cross as shown in the illustration (Fig. 136). Set the jar in the closet and suspend by a string a piece of toasted cheese over the centre of the jar. If there are any mice in the closet the bait will attract them, but just as soon as the first mouse reaches the centre of the paper he will drop into the jar, and the paper will fly back in place again ready for the next comer. A trap arranged in the same manner can be used for the capture of field mice, shrews, and harvest mice, some of which make odd and amusing pets. All of these pretty little animals may be found in the fields or under brush heaps in the clearings. A barrel covered with stiff brown paper can be used for common rats, but they will gnaw out unless the barrel be partly filled with water.

Jug Trap.

An old earthenware jug with a small hole knocked in the



FIG. 137.—Old Jug Trap.

upper part may be utilized as a trap for small burrowing animals. Bury the jug in the earth (Fig. 137) near the haunts of the animal you are after; then arrange an artificial burrow extending from the surface of the ground to the hole in the broken jug;

strew appropriate bait along the passageway, and although the little creatures might hesitate to enter a broken jug above

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ground, they are said to have no fear of one beneath the sod, and either jump or fall inside, where they may be allowed to remain some time with no fear of their escaping.

The jug trap is only suitable for small animals.

The Mole and How to Trap Him.

Moles are, generally speaking, harmless creatures who render the farmer a great service by devouring immense quantities of grubs and larvæ; but when one of these little animals finds its way under the sod of the lawn it plays sad havoc with the looks of the grass, furrowing the surface with ridges, and marring the appearance by dirt hills.

From the fact that the mole travels under ground, I have spent considerable time in trying to find a trap to catch this subterranean animal. Among we boys that lived in the valley of the Ohio River, a mole skin was highly prized as a sort of fetich that, when used as a "knuckle dabster" to rest our hands on in a game of marbles, not only prevented our hands from becoming soiled—which was no great matter—but also insured good luck to the happy boy who

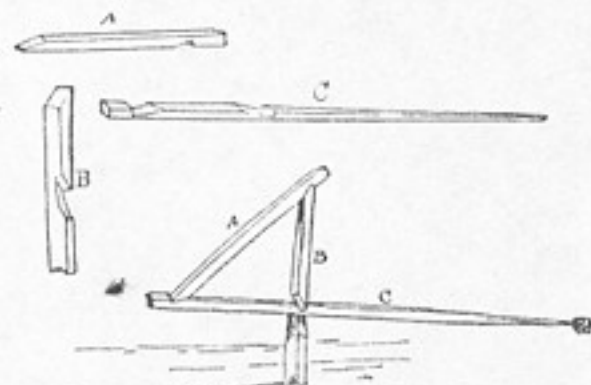


FIG. 138.—Construction of the Figure Four.

possessed a knuckle

dabster made of a mole skin. There are but very few animals that can boast of fur as soft and fine as that which covers the back of the common mole.

A mole trap can be made in the old reliable figure four style, with which most of my readers are no doubt familiar.

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The Figure Four

is made of three sticks; a catch-stick, A, an upright, B, and a trigger, C (Fig. 138). When these sticks are set in the position shown by the diagram, and a weight allowed to rest on the top of the catch, A, the sticks will keep their positions and support the weight until the trigger, C, is touched.

At the slightest derangement of the trigger all the sticks fall, and the weight above, being left without a support, instantly drops to the ground. This trap has been ingeniously adapted to the purpose of a

Mole Trap.

A heavy weight is fastened on a piece of plank or board for a deadfall; in the centre of the board some sharp-pointed spikes or nails are driven, so that the pointed ends extend sev-

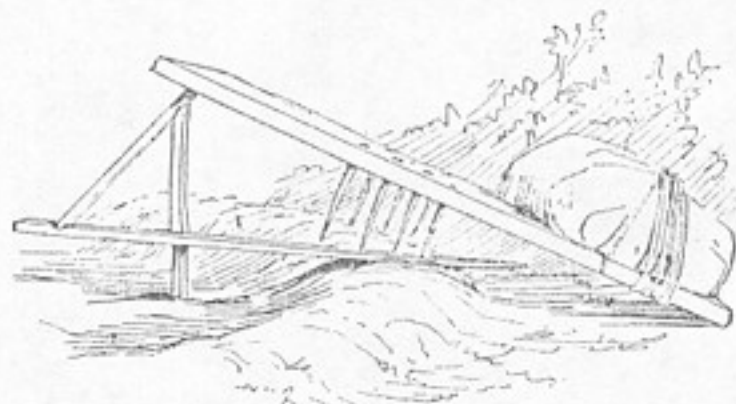


FIG. 139.—Mole Trap.

eral inches below the deadfall (see Fig. 139). This trap should be set over a fresh mole-way, no bait need be used.

First press down the loose earth in a line across the ridge, then set the trap with a figure four, allowing the trigger-stick to rest in the place where you have pressed down the earth across

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the mole hill. The trap should be so arranged that the sharp spikes will be directly over the hill. The next time the mole makes his way through the underground passage he will sooner or later come to the place where the earth has been pressed down to make room for the trigger.

When the little animal reaches this point and proceeds to loosen the earth again, the movement will displace the trigger and bring the dead weight down, pinioning the mole to the ground with the sharp spikes, to which the loose earth of the mole hill offers but little resistance, if the weight be heavy enough. If the skin of the animal be desired, it is best to use as few spikes as practicable, for the fewer holes there are in a pelt the more valuable it is.

I object to deadfalls on principle, and it is not without some reluctance that I include them among the traps. As a boy, the only traps I ever used were made for capturing animals alive; but there are occasions when it is perfectly proper to use a deadfall. If the animal sought is a nuisance upon whose extermination you have settled for good reasons, then use a deadfall, or if you desire the animal for food and have no other

means of capturing him, the deadfall is very convenient. Supposing your supply of fresh meat has run short at camp, or that you are on a canoe trip and are placed under similar circumstances, if there be a rabbit or squirrel in the neighborhood no one will find fault with you for trying to capture the game by any means in your power.

The Toll-gate Trap

is so called either from its resemblance to a toll-gate, or from the fact of its being set across the top of a rail fence, which has been called the "squirrel's highway." This trap can be made in a few minutes with the aid of a pocket-knife and a hatchet. The toll-gate is a deadfall, and the little traveller pays the toll

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with his life. With your hatchet cut a forked stick and drive it in the ground a few feet from the fence; rest one end of a plank on this forked stick and allow the other end to protrude some distance beyond the opposite side of the fence. Select a heavy stick for the deadfall, and a very much smaller stick for the trigger; near the end of the trigger cut a notch for the catch-stick to rest in. Sharpen the ends of two small forked sticks and drive them into splits made near the ends of the board with the corner of the hatchet. Lay a cross piece from one forked stick to the other, and with a bit of string or vegetable fibre suspend the catch-stick from the centre of the cross stick. Tie the inside end of the trigger loosely to the deadfall, and adjust the trap so that when the end of the deadfall rests upon the catch-stick the latter will hold the trigger an inch or so

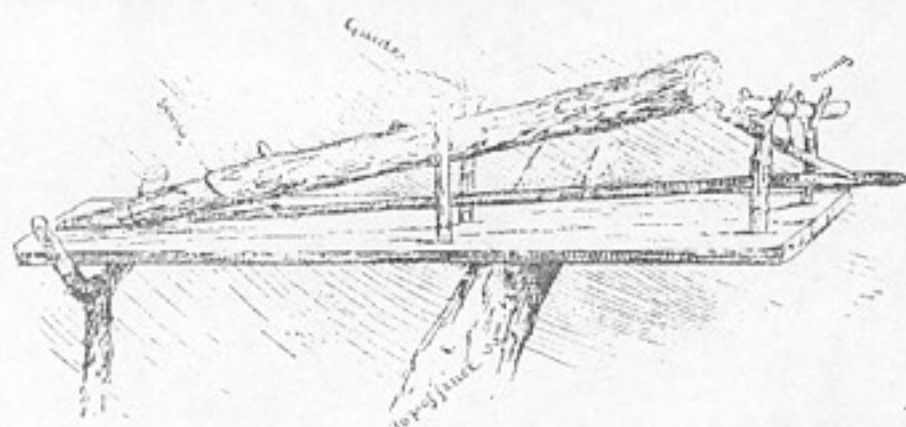


FIG. 140.—Toll-gate Trap.

above the plank. To prevent the trap from swaying and to guide the deadfall in the proper direction, two upright guide-sticks should be erected (Fig. 140). The weight of a squirrel's foot upon the bottom bar slips it from the catch-stick and down comes the deadfall upon the shoulders of the victim.

This same style of trap may be made upon a much larger

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scale and set on logs or trees that have fallen across a water-course and are used as a bridge by minks, coons, or other animals. The forked sticks supporting the end of the plank must in this case be driven into the bed of the creek, and a plank twenty feet long substituted for the short one used in the trap designed for squirrels.

To be a successful trapper a boy must be a keen observer of the habits of the game; by this means he will soon learn to take advantage of the very means designed by Nature as a protection for her creatures. For instance, the partridges are not good flyers, but their unobtrusive coats mingle and blend so closely with the stubble as to take a sharp eye to detect their presence; hence we find that these birds are loth to take to the

wing, but will run along any slight obstruction they meet, poking their heads about to find an outlet, apparently never once thinking of surmounting both the difficulty and the obstruction by using their wings. The "down East" Yankee boys are thoroughly acquainted with the habits of the partridge, and catch a great many of them by building little hedges like the one in the illustration entitled

The Partridge Snare.

The snare in this case consists of a slip-noose made of string. Make a bow-line knot (Fig. 53, diagram XIII., described on page 76) in one end of a piece of common string or fish line; slip the other end of the string through the loop and make the free end fast to the top of an arch made of a bent stick (see Fig. 141). In a semi-circular form, around some feeding ground, build a low fence of sticks, brush or stones, leaving openings at intervals only large enough to fit in arched gateways. Make an arch for each opening and arrange a slip-noose in each archway; spread the loops apart and keep them in this position by catching the strings slightly into notches made upon the outside of

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the arch (see Fig. 141). The birds, when they seek their accustomed feeding place, will walk into the semi-circle, and in searching for an outlet they will go poking their heads about until they come to an archway; here they thrust their heads through the slip-noose, and as, instead of backing out, a part-



FIG. 141.—The Partridge Snare.

ridge will try to force its way through, the noose tightens and holds the bird a prisoner. Sometimes the youthful trapper will find the lifeless body of a rabbit with the fatal noose around its neck, and often he will miss one or two of his arches that have been uprooted and carried away by large game becoming entangled, and walking off, carrying arch, noose, and all with them. This partridge snare will also catch quail or prairie chickens.

Set-Line Snares.

Snares when used for catching birds alive should be closely watched; which will not only prevent the captured wild birds from beating themselves to death, but will save them from suffering any more pain than is absolutely necessary.

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Select a smooth piece of ground and drive two stakes; to these attach a long cord, allowing it to stretch loosely upon the ground from one stake to the other. At intervals along the line fasten strong horse-hair nooses (Fig. 142). Sprinkle food around and retire out of sight to watch. When the birds discover the food they will collect around it, and some one of them



FIG. 142.—Set-Line Snares.

is almost certain to become entangled in one of the snares. As soon as a bird is snared it should be disentangled and put into a covered basket or a paper bag; pin-holes may be made in the bag to allow the air to enter. In this way birds may be carried home without injury; being in the dark they are not likely to hurt or disfigure themselves by struggling for their liberty. A cage is not only an awkward, unwieldy contrivance to carry in the field, but is objectionable from the fact that a wild bird caught and thrust into a cage will bruise its head and wings badly by striking against the bars in the efforts it makes to escape. Paper bags, pasteboard boxes, or covered baskets will do to carry home captured wild birds in.

The Spring Snare.

Make a low arch by pointing both ends of a stick and forcing them into the ground. Cut a switch and bend it into the form of a lawn tennis racket, and with a string fasten the small end of the switch to the part that answers to the handle of the

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bat or racket; just beyond the point where the small end terminates cut a notch in the large part or handle for the catch-stick to fit in. Make a short stick, with one end wedge-shaped, for a catch-stick. Drive a peg at such a distance in front of the arch that when the loop of the spreader is slipped over the peg the notch on the butt end will come just far enough to allow the catch-stick to hold it, as in Fig. 143. For a spring use an elastic young sapling. After stripping off the leaves



and branches, attach a line to the top, tie the other end of the line to the catch-stick, and just above the cross stick fasten one end of a slip-noose to the line. To set the snare, bend the sapling until you can pass the catch-stick under the bender or arch, Figs. 143, 144. Raise the spreader from the ground about an inch; let the catch-stick hold it in this position, and spread the slip-noose over the loop-stick; your trap is now ready. To attract the birds, scatter some appropriate bait inside and very little outside. The birds will follow the trail of food up to the stretcher, and seeing the bait inside will hop upon the stretcher preparatory to going within. The stretcher, being only supported by friction where it bears against the

catch and peg, will drop under the weight of a very small bird. The catch loosened slips out from under the bender, and the spring flying suddenly back draws the slip-noose around the wing, legs, or neck of the unfortunate bird. Unless speedily released by the trapper the bird will strangle or beat itself to death against the ground, or any objects within reach. *All snares should be watched if the birds are wanted alive.*

Hen-Coop Trap.

This rustic trap is sometimes set with an ordinary figure four (Fig. 138) by the colored people down South, and with it they catch a great many wild ducks and other water fowl.

The coop is made of sticks piled up after the manner of a log cabin (Fig. 145).

To one of the bottom sticks a withe, made of a green wand,* is attached; the other end is then brought over the top of the trap and attached to the bottom stick upon the opposite side. The withe is tightened by forcing sticks under it at the top of the coop. When all is taut the sticks keep their positions, and unless very roughly used



FIG. 145.—Hen-Coop.

* Withes may be made of osier, willow, alder, hazel, white birch, white cherry, or even cedar branches.

Cut a branch or sapling, and after trimming the small branches off, place the small end under one foot, grasp the large end with both hands, and by a revolving motion twist the wand until the fibres become loosened and the stick looks like a rope. Indeed it will be a vegetable rope, which, if well made, will bear considerable strain, and be not only serviceable in making traps, but answer for binding logs together for a raft. Remarkably good and strong swings can be made of withes of wood.

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will not slip out. Fig. 146 shows another manner of setting the hen-coop trap, by fastening a piece of willow or any other similar wood by two strings or withes to one end of the coop, so as to allow considerable freedom of motion to the semi-circular arch formed by the willow, which should be small enough

and bent in such a manner that all parts of the arch will come inside the coop. Take two forked sticks and make the straight part of one of such a length that it might support one end of the coop. Cut one of the forks off the second stick and leave about two inches of the other fork on (see B, Fig. 146). Make B about an inch shorter than A

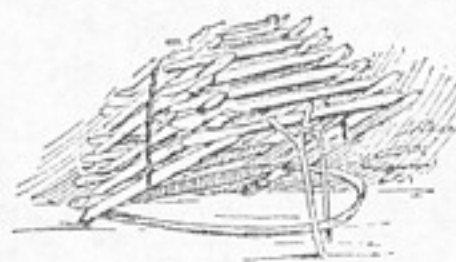


FIG. 146.—Hen-Coop Trap.

(Fig. 146). Raise the side of the coop, thrusting the crook on the end of B through the fork on the end of A, slip the crook under the edge of the coop, and push the bottom of B back inside of the willow, lifting the latter high enough to bear on the stick B and hold it in position. A will rest outside the coop, as in the illustration. A bird hopping upon the willow wand will cause it to slip down; this will displace the stick A, loosen the catch, and down comes the coop, enclosing the bird. A rustic trap of this description can be made without the aid of any other tools than a hatchet or a knife for cutting the sticks.

DOGS.

What They are Good For and How to Train Them.

It is true that a boy *can* do without a canine companion and live to enjoy life, but he is almost incomplete; he lacks something; he has lost a gratification, a harmless, pleasant experience, and the loss leaves an empty space in his boyhood life that nothing can ever quite fill up. A boy without a dog is like an unfinished story. What your left hand is to your right, a boy's dog is to the boy. More particularly is all this true of the lad who lives either in the country or within walking distance of forest and stream.



To be of any value either as a hunting dog, a watch dog or even a companion in one's rambles, it is absolutely necessary that the dog should be educated, and where there is a possibility of doing so, it is desirable to secure a young puppy. No matter what your choice in breed may be, whether it is a Newfoundland, bull, skye, greyhound, pointer, setter, or toy terrier, get the pup and *train it yourself.*

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How to Choose a Dog.

"Blood will tell," whether it flows in the veins of a horse, man, or dog. The reader can readily understand that it would be not only absurd but absolutely cruel to keep a Newfoundland, deer-hound, water-spaniel, pointer, setter, or any other similar breed of dog confined within the narrow limits of that small bit of ground attached to the city house and dignified by the name of a yard. It would be equally as absurd and almost as cruel for a farmer boy to try and keep one of those expensive, diminutive, delicate, nervous, city dogs known under the general title of a "toy dog" or "fancy breed." The agile, bright-eyed "black-and-tan," and the delicate and graceful Italian greyhound, are full of fun, but as unreliable as beautiful. Thoughtless, rollicking, exquisites! Such dogs are scarcely the kind either city or country boy would choose for playmates or companions. What most boys want is a dog that combines the qualities of a boon companion and a good watch dog. By the latter is meant a dog whose intelligence is sufficient for it to discriminate between friend and foe, and whose courage will prompt it to attack the latter without hesitancy. It must also be a dog that may be taught to "fetch" and carry, to hunt for rat, squirrel, or rabbit, as well as to obey and trust in its master. It should be so cleanly in his habits as to be unobjectionable in-doors, and should possess judgment enough to know when its company is not agreeable, and at such times keep out of the way.

The poodle is perhaps the best trick dog, but is disliked by many on account of its thick woolly coat being so difficult to keep clean. The wirey-haired Scotch terrier is a comical, intelligent animal, and a first-rate comrade for a boy. The Newfoundland is faithful, companionable, and powerful enough to protect children, to whom, if there be any around the house, it

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will become very much attached and a self-constituted guardian. The spaniel is pretty, affectionate, and docile.

Almost all the sporting dogs make first-class watch-dogs, but are restless and troublesome if confined, and, as a rule, they are too large for the house. The shepherd is remarkably intelligent, and, when well trained, makes a trusty dog for general purposes.

The bull, although not necessarily as fierce and vicious as one would suppose from its looks and reputation, still is hardly the dog for a pet or companion, being of a dull and heavy nature, and not lively enough to suit the taste of the boy of the period. A little of the bull mixed in the blood of another more lively breed makes a good dog, of which a thoroughbred bull-terrier is an example. The Rev. J. G. Wood, in speaking of the latter, says:

"The skilful dog-fancier contrives a judicious mixture of the two breeds, and engrafts the tenacity, endurance, and dauntless courage of the bull-dog upon the more agile and frivolous terrier. Thus he obtains a dog that can do almost anything, and though, perhaps, it may not surpass, it certainly rivals almost every other variety of dog in its accomplishments. In the capacity for learning tricks it scarcely yields, if it does yield at all, to the poodle. It can retrieve as well as the dog which is especially bred for that purpose. It can hunt the fox with the regular hounds, it can swim and dive as well as the Newfoundland dog. In the house it is one of the wariest and most intelligent of dogs, permitting no unaccustomed footstep to enter the domains without giving warning." Although some may think the Rev. J. G. Wood to be a little too enthusiastic in his description of the bull-terrier's good qualities, still if they have ever owned a properly trained animal of this breed, they will undoubtedly agree with the great naturalist so far as to acknowledge this particular dog to be about the best for a

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boy's dog. With an ardor not excelled by his young master, the bull-terrier will chase any sort of game, and will attack and fight any foe at its master's bidding. Indeed the great fault of this kind of dog is that it is inclined to be too quarrelsome among other dogs, and careful attention should be paid to correcting this fault, which may be entirely eradicated by kind and firm treatment; but should any canine bully attack your pet, woe be unto him, for, unless he comes from good fighting stock, he will rue the day he ever picked that quarrel.

How to Train Dogs.

First of all teach your dog that you mean *exactly what you say*, and that he *must* obey you. To do this you should never give a foolish command; but if a thoughtless order be once given, even though you repent it as soon as it has escaped from your lips, do not hesitate, but insist upon your pupil instantly obeying—that is, if the dog, in your judgment, understands the order. Never, under any circumstances, allow him to shirk, and even a naturally stupid pup will learn to look upon your word as law and not think of disobeying.

Strict obedience to your word, whistle or slightest gesture once obtained, it is an easy task to finish the dog's education. Bear in mind that there is about as great a difference in the character and natural intelligence of dogs as there is in boys. Not only does this exist between the distinct varieties of dogs, but also between the different individuals of the same variety.

All Newfoundlands possess similar characteristics, but each individual varies considerably in intelligence, amiability, and all those little traits that go to make up a dog's character. I mention this fact that you may not be disappointed, or make your poor dog suffer because it cannot learn as fast or as much as some one you may know of. And here let me say, and impress upon your mind, that to make your dog obey, or to teach it

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the most difficult trick or feat, it is seldom necessary to use the whip. If the dog, as he sometimes will do, knowingly and wilfully disobeys, the whip may be used sparingly; one sharp blow is generally sufficient; it should be accompanied with a reprimand in words. Never lose your patience and beat an animal in anger. To successfully train a dog it is necessary to place the greatest restraint upon your own feelings, for if you once give way to anger the dog will know it, and one-half your influence is gone. To be sure the special line of education depends upon the kind of a dog you have, and what you want him to do.

The pointer or setter you may commence to teach to "stand," at a very early age, using first a piece of meat, praising and petting him when he does well, and reprimanding when required. Do not tire your pup out, but if he does well once let him play and sleep before trying again. As he grows older, replace the meat with a dead bird. The best sportsmen of to-day do not allow their bird dogs to retrieve, saying that the "mouthing" of the dead and bloody birds affects the fineness of their noses. To bring in birds, the sportsman has following at his heels a cocker spaniel, large poodle, or almost any kind of dog, who is taught to follow patiently and obediently until game is killed and he receives the order to "fetch."

To Teach a Dog to Retrieve.

Commence with the young pup. Almost any dog will chase a ball and very soon learn to bring it to his master. When you have taught your dog to "fetch," he may be tried with game. It is very probable that the first bird he brings will be badly "mouthed;" that is, bitten and mangled; to break him of this, prepare a ball of yarn so wound over pins that the slightest pressure will cause the points to protrude and prick any object pressed against the ball. After the dog has pricked his mouth

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once or twice with this ball he will learn to pick it up and carry it in the most delicate manner; he may then be tried again with a bird. This time he will probably bring it to you without so much as ruffling a feather; but if notwithstanding his experience with a ball of pins your dog still "mouths" the game, you must skin a bird and arrange the ball and pins inside the bird skin so as to prick sharply upon a light pressure; make the dog "fetch" the bird skin until he is completely broken of his bad habit of biting or "mouthing" game.

Pointers and Setters.

At first you will have to give your commands by word of mouth, but if you accompany each command by an appropriate gesture, the pup will soon learn to understand and obey the slightest motion of the hand or head. The less noise there is the greater is the chance of killing game. Nothing is more unsportsmanlike than shouting in a loud voice to your dog while in the field.

After teaching a dog to "heel," "down charge," and to

"hi on" at command, you may show him game and teach him to "quarter" his ground by moving yourself in the direction you wish the dog to go. The dog will not be long in understanding and obeying.

When your pointer comes to a point teach him to be steady by repeating softly, "steady, boy, steady," at the same time holding up your hand. In course of time the words may be omitted; the hand raised as a caution will keep the dog steady; but should he break point and flush the game, as a young dog is more than liable to do, you may give him the whip and at the same time use some appropriate words that the dog will remember; the next time the word without the whip will correct him. After your dog has been taught to obey, it is well to put him in the field with an old, well-trained dog.

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As every sportsman has a peculiar system of his own for breaking a dog, it is scarcely necessary for me to give more than these few hints; only let me again caution you against using the whip too often. Spare the lash and keep a good stock of patience on hand; otherwise in breaking the dog you will also break his spirit and have a mean, treacherous animal that will slink and cringe at your slightest look, but seldom obey you when he thinks he is out of reach of the dreaded whip.

Pet Dogs.

All dogs, whether intended for the field, for pets, or for companions, should be taught to follow at their master's heels at the command of "heel," to run ahead at the command of "hi on," and to drop at the command of "charge" or "down charge." When your dog learns to obey these simple commands, it will be found an easy matter to extricate and keep your canine friend out of scrapes. Suppose you have a small but pugnacious dog and in your walk you meet a large, ugly-tempered brute much too powerful for your own dog to master in the fight that is certain to ensue unless by some command you can prevent it. The strange dog will not obey you, but if you give the order to "heel" to your own dog he will follow with his nose at your heels, and the enemy will seldom if ever attack a dog while so near his master.

Study the characteristics of your dog, and by taking advantage of its peculiarities it may be taught many amusing tricks. I have a little dog called Monad, and whether his master walks, drives, sails or rows Monad always accompanies him, even sitting in front of the sliding seat of a single shell boat for hours at a time, perfectly happy and apparently conscious of the attention he attracts from all people on the shore or in the passing boats; the latter he generally salutes with a bark. Monad will, when requested to do so, close a door, sneeze, bark, or sit

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upon his haunches and rub his nose, besides numerous other amusing tricks.

One day Monad smelled of a lighted cigar; the smoke inhaled caused him to sneeze; this gave me an idea; lighting a match I held it toward him, at the same time repeating, "sneeze! sneeze, sir!" The smoke made him sneeze, and after repeating the operation several times I held out an unlighted match and commanded him to sneeze; the dog sneezed at once. It was then an easy step to make him sneeze at the word without the match. Monad is now very proud of this accomplishment, and when desirous of "showing off" always commences by sneezing.

In much the same manner I taught him to rub his nose by blowing in his face and repeating the words, "rub your nose." The breath coming in contact with that sensitive organ apparently tickled it and he would rub it with his paws. After one or two trials he learned to rub his little black nose in a very comical manner whenever commanded to do so. By patting your leg with your hand and at the same time calling your dog, it will learn to come to you and place his fore paws against your leg. If you take advantage of this and pat the door the next time with your hand, the dog will stand on its hind legs and rest its fore paws against the door. Reward him with a bit of meat or a caress, and then opening the door a few inches go through with the same performance, giving the command to close the door; by degrees, as the dog learns, open the door wider, and without moving from your chair or position in the room give the command, "close the door, sir." The dog will by this time understand your meaning, and resting his fore paws against the panels, follow the door until it closes with a bang. Perhaps there is no simple trick that excites more surprise than this. A friend comes in and leaves the door open; you rise, greet your friend, ask him to be seated; then, as if for the first

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time noticing the fact of the door being open, speak to your dog; the latter closes the door and lies down again by the fireside in a most methodical manner. The friend is thoroughly convinced that that particular dog has more sense than any other canine in the world, and ever after, when dogs are the topic of conversation, he will tell the story of the dog that shut the door.

In the same manner innumerable odd, amusing, or useful tricks may be taught, among the simplest of which are the ones which excite the most applause from spectators. If your dog is fond of carrying a stick in his mouth, it will be an easy matter to make him carry a basket. Take advantage of every peculiarity of your pet's character, encouraging and developing the good points, but keeping the bad traits subdued, and you will soon have an amusing and reasoning canine companion.

Never throw a dog into the water; it frightens him and makes the poor animal dread a bath. Let the dog wade at first; then by throwing sticks or other objects a little further out each time, and commanding him to fetch, the dog will not only learn to swim after the object, but also learn to thoroughly enjoy the bath, and can even be taught to dive and jump off of high places. There are dogs that will jump from an elevation twelve feet above the water. Always be firm but kind; teach your dog to have confidence in you, and you may place implicit trust in your canine friend, and be sure whatever misfortune befalls you, you will have a friend who, though he be a four-footed one, will never forsake you, but live and die for the master it has learned to love and trust.

CHAPTER XXV.

PRACTICAL TAXIDERMY FOR BOYS.

To the practical naturalist a knowledge of taxidermy is not only an interesting accomplishment from which to derive amusement, but is almost an absolute necessity, an indispensable adjunct to his profession. Probably there is no study the pursuit of which affords such opportunities for physical exercise and real healthy enjoyment as that of natural history. It is a study that, by broadening the horizon of thought, enlarges

the capacity for pleasure. To the pride of the sportsman in exhibiting the results of his skill and success, the naturalist adds the intelligent pleasure of acquiring a more complete knowledge of the life and habits, nature and anatomy of his trophies, as well as the ability to detect at a glance any unknown genus or rare variety he may capture; and here the practical knowledge of taxidermy enables him to properly preserve the otherwise perishable specimen.

Captain Thomas Brown, F.L.S., says that *boys* ought to be instructed in the art of stuffing birds and mammals. So, boys, you have good authority for commencing young; but do not suppose that after reading the following directions you can sit down, and, without any previous experience, set up a bird as neatly and perfectly as one of those you see in the museums or show windows. On the contrary, you must expect to make one or two dismal failures, but each failure will teach you what to avoid in the next attempt.

Let us suppose an owl has been lowering around suspi-

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ciously near the pigeon house or chicken coop, and that you have shot the rascal. Do not throw him away. What a splendid ornament he will make for the library! How appropriate that wise old face of his will be peering over the top of the book-case! (Fig. 147). He must be skinned and stuffed! With a damp sponge carefully remove any blood-stains there may be upon his plumage. Plug up the mouth and nostrils with cotton; also insert cotton in all the shot holes, to prevent any more blood oozing out and soiling the feathers. You may then lay him aside in some cool place until you are ready to begin the operation of skinning and stuffing the owl.



FIG. 147.—Stuffed and Mounted.

Measure the length of the bird, following the curves of the form, from root of tail to top of head, and its girth about the body; make a note of these figures.

Skinning.

Place the bird on its back upon the table, in such a position that the head will be toward your left hand; then, with the knife in your right hand you are ready to make the incision.

With your left hand separate the feathers, left and right, from the apex of the breast-bone to the tail (Fig. 148). Cut a straight slit through the skin between these points, using the utmost care to prevent the knife penetrating the flesh or the inner skin which encloses the intestines. With a bird as large as the owl, you will find that you can easily separate the skin from the flesh with your fingers, though it may be best to use a blunt instrument, such as a small ivory paper-cutter, to reach

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the back by passing it underneath the skin. In removing the skin you must try to shove in lieu of pulling, lest you stretch it out of shape. Press as lightly as possible upon the bird, stopping occasionally to take a view to see that all is right and that the feathers are not being soiled or broken. When you come to the head do not let the skin dangle from your hand or its own weight will stretch it. Bearing these things in mind, you can commence removing the skin in the following manner: Press



FIG. 148.—The Incision.

the skin apart at the incision, and last the exposed part with Indian meal to absorb any fluids that may escape; carefully lift the skin on one side and separate from muscles of the breast with the

point of your knife and a small ivory paper-folder alternately, as occasion may require, until the leg is reached and you have approached as near as possible to the wings. Having accomplished this, and dusted again with the Indian meal, the thighs must be pressed inward and the skin turned back far enough to allow you to use your knife and disarticulate the hip-joint. Bend the tail toward the back; keep down the detached skin upon each side of the incision with the thumb and first finger of the left hand; then with your knife make a deep cut, exposing the backbone at a point near the oil gland, which you will find near the root of the tail; sever the backbone near this

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point, but be careful to leave a large enough piece of it to support the tail feathers.

Take the part of the body which is now denuded of the skin in the left hand and peel the skin upward to the wings; during this operation your knife or small scissors may be used to cut any of the tendons which are met with. Separate the wings from the body at the shoulder-joint. Next turn your attention to the head and neck. Push the skin back toward the head, after the manner of removing a kid glove from the finger, until the back part of the skull is laid bare; then with your knife detach the vertebræ (neck bone) from the head. This will sever all connection between the body and the skin. The dismembered, denuded carcass may be thrown aside and your attention turned to skinning the head, which member in an owl is so large in proportion to the neck that care must be used in drawing the skin of the neck over it, lest you stretch the skin. A great deal depends upon the delicacy of your touch, especially when you reach the eyes. Work slowly; cut the ears close to the skull; do not cut either the eyelid or the eyeball, but separate them carefully; then remove the eyes, which can be done by breaking the slender bones which separate the orbits (eye-holes) in the skull from the top of the mouth. Cut away all flesh from the neck; at the same time remove a small portion of the base of the skull. Through the opening thus made extract the brains with a small spoon or some similar instrument, after which draw the tongue through the same cavity. After removing all fleshy particles from the head and neck, and scraping out the eye-holes, paint them with arsenical soap and stuff them tightly with cotton. Be careful not to detach the skin from the bill, as the skull must be left in place. Coat the interior of the skull with arsenical soap and fill it with tow.

The wings and legs still remain intact. Push back the wings

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to the first joint; lay the bones bare, removing all the meat. Paint with arsenical soap and return them to their places. Go

through the same process with the legs and rump; and after all flesh and fatty matter have been removed, paint the whole interior of the skin thoroughly with arsenical soap, and you are ready to begin the operation of

Stuffing.

Take a piece of straight wire (size 20) equal in length to the measurement you made from root of tail to top of head; wind about it a bunch of excelsior (straw will answer as a substitute for excelsior shavings); secure this to the wire by repeated wrappings of stout thread, and mould the bundle into a shape resembling the bird's body; regulate the girth by the measurement you noted down for that purpose before you commenced the skinning process. When you have completed the artificial body there will, of course, be a portion of the

wire still bare, which represents the neck. File the extremity of this wire to a sharp point, then force it diagonally up through the skull to the top, where it must be clinched; wrap the neck wire between the artificial body and the head with cotton batting (Fig. 149). Now draw the skin back so as to cover the artificial neck and body.

The eyelids must be carefully pulled in place over the cotton in the eye-holes, or orbits; pull the eyelids up nicely, to

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make the parts about the eye appear plump and natural. Push more cotton down the throat until it has a round, real look. For the legs use two pieces of wire, each sharpened at one end. The taxidermist must shove the wire through the ball of the foot and guide it with the other hand up along the side of the bones of the leg, the skin being turned back for that purpose (Fig. 150). This figure shows the leg with skin turned back, as it appears when the wire is pushed through.

Wind cotton around both wire and bone to the natural thickness of the thigh, and go through the same process with the other leg; then push the wires clear through the artificial body and bend the protruding ends into a hook form (Fig. 151). Taking hold at the part extending from the bottom of the foot, pull the wire of each leg down until the hooks fasten firmly into the

body. The ends of the wires protruding from the foot are left to fasten the bird to its perch, which is done either by wrapping the wires around the perch or by thrusting them through holes made for the purpose and clinching the



FIG. 149.—Owl-Skin and False Body.



FIG. 150.—Wiring the Leg.

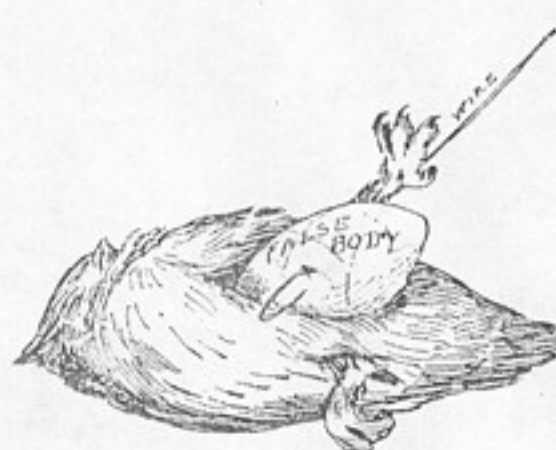


FIG. 151.—Showing how Leg-Wire is attached to False Body.

ends. With a few stitches sew up the

hole in the breast. For small birds this is not necessary. After your owl is set up in

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this manner, gather the wings up close to the body and fasten them there by thrusting two wires, one from each side, diagonally through the skin of the second joint.

If you wish the tail to be spread you must push a wire across the body through each feather.

Eyes can be made of white marbles painted yellow with black centres, but glass eyes are better and cost very little. To fix the eyes, put a touch of glue upon the cotton in each orbit and insert the glass eyes, being careful to place them properly under the eyelids; with a sharp needle pull the lids nicely in place.

The stuffing of the bird is now finished, and it may be placed upon the branch in some natural position (Fig. 147, page 233).

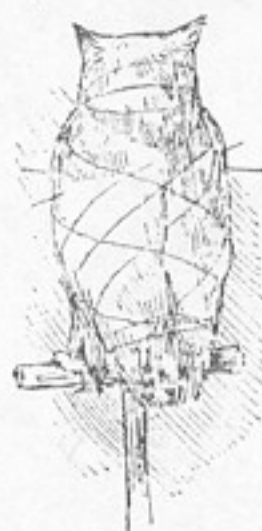


FIG. 152.

The attitude fixed, it only remains to put the feathers in their natural order as smoothly and regularly as possible, and to keep them in place by winding a thread over the body very loosely, beginning at the head and winding until all the feathers are secured (Fig. 152). The bird must be left in some dry place for several days. When it is perfectly dry the thread may be taken off and all protruding wires cut close to the body. The specimen is now ready for the parlor or library.

The above directions, with very little modification, will serve for any other bird.

For practice, a chicken is the best subject, as it is easily obtained and large enough not to be readily damaged by the awkwardness of a beginner.

The more tools you have the better, but if my reader has carefully read the foregoing description he must have noticed that during the whole process of skinning and stuffing the owl

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the only tools used were such as are within the reach of every boy—a penknife, a paper-cutter, small spoon (a mustard-spoon will answer), and a thread and needle. Arsenical soap is the only material used not likely to be easily procured. This preparation is of course very poisonous and should be so labelled. It can be procured of any taxidermist or made by any druggist from the following recipe of Bécœur:

Arsenic in powder.....	2 pounds.
Camphor.....	3 ounces.
White soap.....	2 pounds.

Salt of tartar.....	12 ounces.
Powdered lime.....	4 ounces.

Mr. J. Wallace, the taxidermist, recommends the following recipe: "Dissolve ten pounds of finely cut, best white soap in warm water; add one pound of potash; thicken with pipe-clay and a little lime to give the preparation body; heat and stir well. When cooling add ten pounds of arsenic." Of course the young beginner will not need any such quantity as is represented in either of these recipes, but if he goes to the druggist that gentleman can make the soap in any quantity desired. The utmost care must be observed in handling this preparation and keeping it out of the reach of children and animals, although it is not very tempting in taste or looks and hence not as dangerous as other compounds might be.

A New Manner of Preserving Fish.

The boys at school used to say, "You cannot eat your apple and keep it." Being not only fond of fishing and fish, but also taking an interest in the study of ichthyology, the question with me has been, How can I eat my fish and still pre-

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serve it for future reference? A few experiments and several failures suggested a plan which has proved partially successful.

Having caught a very large bass or trout that you would like to preserve as a trophy, or some odd-looking fish that you want to keep as a specimen, the following is the plan to adopt:

Place your fish upon a piece of paper of any kind you may have, or a piece of birch bark; spread out the fins and trace a careful and accurate outline; then with your pocket-knife remove the tail at a point just beyond its junction with the body of the fish; in the same manner cut off the fins, being careful not to injure them; a small portion of flesh will be attached to



FIG. 153.—Portfolio of Fish.

each; this must be removed with your knife. Put the fins in a safe place, and again taking your knife, insert the blade under the gill and cut up to the centre of the top of the head; split the head down in a line exactly on the top to the upper jaw; carefully cut through this and the lower jaw to where the gill commences underneath; this will sever the whole side of the head. Cut away all the flesh from the inside and remove all the bony structures possible without injuring the outside. The eyes can be removed so as to leave the outside skin or covering unbroken. Wash the half of the head clean and put that with the fins in your note-book, taking care to leave a leaf of paper between each, to prevent their adhering together.

When you reach home you can have the fish cooked, and while it is cooking trace the outline of the fish upon a clean sheet of white paper; take the fins, head and tail from your note-book, dampen them with a sponge or wet cloth, and with glue or mucilage fasten them in their proper places upon the

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outline drawing, distended by means of pins; the latter may be removed after the glue or mucilage is dry; write in one corner the weight of the fish, the date upon which it was caught, and the name of the place where it was captured. You

can then frame it or number the sheet and place it in a portfolio (Fig. 153). In the course of a season's fishing quite an interesting and valuable portfolio of fishes can be made. The writer has often caught fish whose names were unknown to him, and in this manner preserved them, or enough of them to identify the fish at some future period when he had time to look it up.

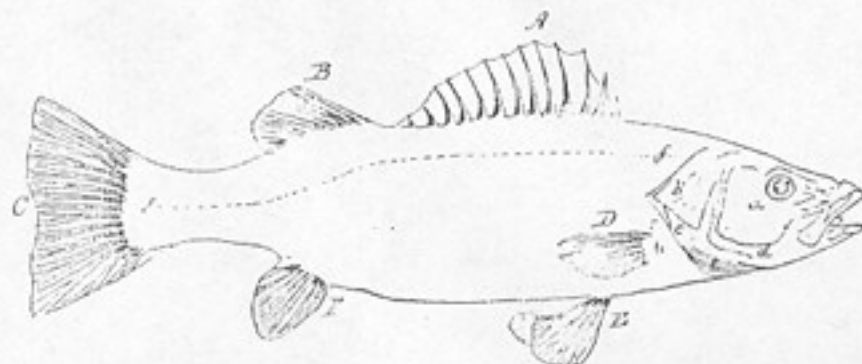


Diagram Showing the Parts of a Fish.—A, first dorsal fin; B, second dorsal fin; C, caudal fin; D, pectoral fin; E, ventral fin; F, anal fin; a, operculum or gill cover proper; b, preoperculum or fore-gill cover; c, interoperculum, or middle gill cover; d, suboperculum, or under gill cover; e, branchiostegous, or gill rays; f, lateral line.

Design for a Sketching Aquarium.

If the reader desire to try his artistic skill and attempt a colored drawing of a fish, he should do it from life. To see the fish as it really appears, a very simple contrivance can be made in the form of an aquarium, with wooden ends and glass sides; the wooden ends must have perpendicular grooves in them so

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that an extra pane of glass can be used as a slide (Fig. 154). Place the live fish in the aquarium, and when he is on one side

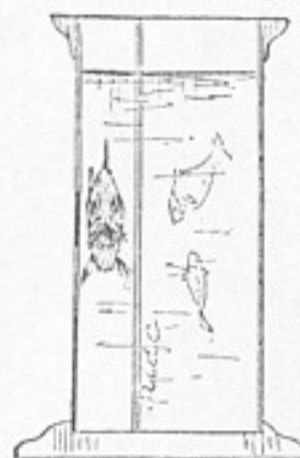


FIG. 154.—Cross Section of a Sketching Aquarium.

of it quickly slip the slide in so as to imprison the fish in such a narrow space that he is unable to flop or turn around, but must patiently keep his broadside to the artist until the picture is finished.

Preserving Insects.

Great care must be taken in killing insects, intended for the cabinet, and death should be produced without disfiguring them or rubbing off the down or scales that covers the bodies and wings of some specimens. A convenient and successful way to kill insects is to drop them into a wide-mouthed bottle, the bottom of which is lined with blotting-paper that has been previously saturated with ether, benzine, creosote or chloroform. When a butterfly, bug, or beetle is put into a bottle prepared in this manner, and the bottle tightly corked, the insect expires without a struggle, and hence without injuring itself. From the bottle

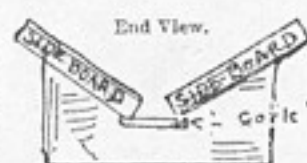
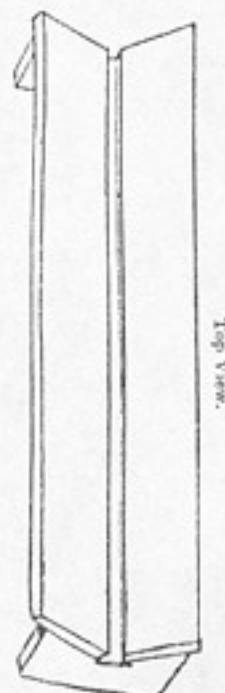


FIG. 155.—Mounting-Board.

the specimens may be taken and pinned upon a mounting-board, consisting of two strips of wood resting upon supports at

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each end, a space being left between the strips for the body of the insect. Under this space or crack a piece of cork is fastened (Fig. 155) in which to stick the point of the pin. After pinning the specimen to the mounting-board, spread the wings and

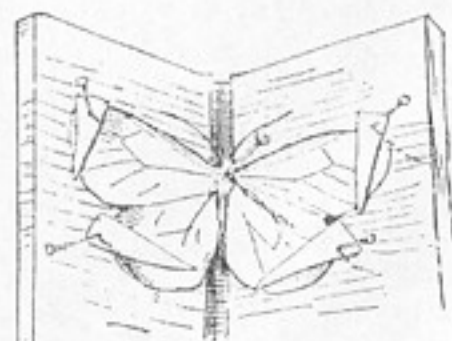
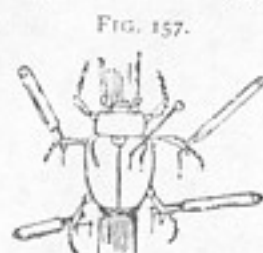


FIG. 156.—Butterfly pinned to Mounting-Board.

legs out in a natural position, and if it be a butterfly or moth, fasten its wings in position with bits of paper and pins, as shown in Fig. 156. An ingenious and simple device for pinning the leg of an insect is illustrated by Fig. 157. It consists of two needles with their heads driven into a small pine stick.



Beetle, with legs set.



Leg-pin.

Morse Insect Box.

Mr. E. S. Morse gives probably the best device for arranging an insect box for the cabinet. It consists of a light wooden frame with paper stretched upon the upper and under surface. Dampen the paper and glue it to the frame; when the paper dries it will contract and become as tight as a drum-head. Inside the box upon two sides fasten cleats, and let their top edges be about one-quarter of an inch above the bottom. Rest



FIG. 158.—Cross Section of Morse Insect Box.

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the paper-covered frame upon these cleats and secure it in position. The bottom of the box should be lined with soft pine to receive the points of the pins. The space under the frame can be dusted with snuff and camphor to keep out such insects as delight to feed upon the prepared specimens of their relatives. Fig. 158 shows a cross section of a box upon Mr. Morse's plan.

The Lawrence Breeding Box.

The best moths and butterflies are obtained by rearing the caterpillars in cages made for the purpose. I am indebted to Mr. Albert Lawrence for the accompanying plan of a larvæ box, invented and used by himself for several seasons (see Fig. 159). The Lawrence box, as may be seen by the diagram, can be taken apart and packed away when not in use or during transportation.

The sides, ends, and top are wooden frames covered with wire netting; the bottom is a flat board. They are all joined by hooks and screw-eyes. To take them apart it is only necessary to unfasten the hooks.

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Spiders

are very likely to lose their colors if placed in spirits, and if pinned and dried like beetles they will not only lose all color,

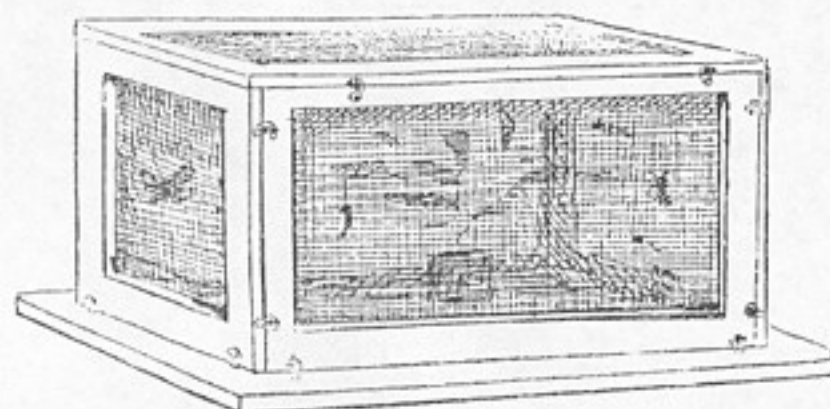


FIG. 159.—Mr. Albert Lawrence's Breeding Box.

but their bodies will shrivel up and change in form and proportion to such a degree as to make the specimens next to worthless. Mr. Ralph Hemingray, of Covington, Ky., sent the author some spider bottles manufactured under his direction of very thick, clear, white glass, three inches high by one and one-quarter inch broad, and three-quarters of an inch thick. These bottles are convenient in shape, and when a spider is put in one and the bottle filled with glycerine, the spider looks as if it might be imbedded in a solid block of crystal.

I have had some brightly colored garden spiders preserved in this manner for two years, and they have not only retained their original shape but color also. In the place of corks, pieces of elastic are stretched over the tops of the bottles; this allows the glycerine to expand or contract. Fig. 160 represents a drawing of one of these bottles with a spider in it. A case of specimens preserved in this manner makes not only an interesting cabinet, but a very pretty one. Although many persons have a horror of spiders, they lose all their nervousness when the insects are seen neatly labelled and enclosed in pretty glass bottles.



FIG. 160.—The Hemingray Bottle.

How to Make Beautiful or Comical Groups and Designs of Insects.

Many really beautiful, as well as some absurdly comical designs can be made of properly preserved insects by ingenious lads.

Butterflies may be made to have the appearance of hovering in mid-air by mounting them upon extremely fine wire.

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Grasshoppers can be arranged in comical, human-like attitudes.

Beetles may be harnessed like horses to a tiny car made of the half of an English walnut-shell. A very pretty design can be made by seating a grasshopper in a delicate sea-shell of some kind, and glueing the shell to a bit of looking-glass; fine wires attached to the shell will answer the double purpose of a support and harness for a couple of flying beetles; a little moss glued around the sides so as to conceal the ragged edges of the glass will add greatly to the effect, and the whole will have the appearance of a fairy boat being drawn over the surface of the water by two flying beetles, guided by the long-legged imp in the shell.

Preserved insects are exceedingly brittle, the least touch will often break off a wing or leg or otherwise disfigure the specimen, hence it is necessary not only to be very careful in handling them, but to supply some sort of cover to protect them from accidents, dust, and injurious insects. Dome-shape glass-

covers are best adapted for small groups or compositions, and these may be obtained from the dealers at moderate prices, or, if the young taxidermist has acquired sufficient skill to make his work valuable, he can readily trade off duplicate specimens for glass-covers, as many amateurs as well as some professionals do.

Marine Animals.

Starfish must be first placed in fresh water and allowed to remain there for several hours; they may then be removed and spread out upon a board, and held in position by pins or nails driven in the board alongside of the rays, but not into the creature. Put the board in a dry place out of the sun, and the air will absorb all the moisture in the specimens; the latter, as they dry, become hard and stiff.

I have several starfish preserved in this simple manner, and

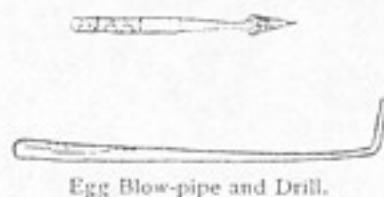
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although no pickle or artificial preservative was used, they have kept in good condition for several years.

Small crabs may be dried in the same manner. The flesh must be extracted from the big pincers of the larger crabs and lobsters; this may be done by breaking off the points of the pincers and removing the meat with a crooked wire. The points of the claws should be saved and glued in place after the animal is dry. The smaller claws may be allowed to dry; small holes pierced in them will allow the air to enter and facilitate the drying process. The insides of both lobsters and large crabs must be removed from an opening made underneath. Wash them with cold water and inject carbolic acid and water into their extremities; place them upon a board to dry, with their legs spread out; after all moisture has evaporated, varnish them and fasten the bodies and legs of the specimens to a board with fine wires.

All soft-bodied animals, such as squids and slugs, can be preserved in spirits. Sea-urchins, such as are found upon our coast, may be dried like starfish, but it is best to remove the insides of the larger specimens.

With these suggestions, sufficient to help the young taxidermist, I will close this chapter. I have purposely avoided advising the use of expensive material or tools; where it was possible, I have not suggested the use of poisonous preservatives, but have given the most simple and safe methods of mounting specimens for the cabinet or for decorations.



Egg Blow-pipe and Drill.

CHAPTER XXVI.

EVERY BOY A DECORATIVE ARTIST.

Shadow Pictures—Photographic Paper—How to Enlarge or Reduce a Picture, etc.

ONE day while the author was sketching, a piece of drawing-paper happened to fall upon the ground in the bright sunlight. As the paper rested on the sward the shadows of the grass and



FIG. 161.—Shadow cast by a Dandelion.

weeds were cast upon it. How beautiful and graceful they were! Stooping down the writer passed his brush over the shadows; the result was a sort of half silhouette, an excellent suggestion for a bit of foreground or a decoration. If the thousands of amateur decorators that are daily engaged in daubing pictures of all manner of unnatural-looking plants upon china would only confine themselves to tracing in one color the simple shadows cast by plants in the sunlight, what graceful and pleasing designs Mother Nature would furnish

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them! How much more pleasant it would be to eat off dishes decorated in this manner than to be called upon to admire and eat from china covered with "finiky" little flowers or broad, meaningless daubs of color intended to represent something only known to the artist (?) who conceived the design. Any boy can make the most graceful designs by placing a piece of paper in such a position that the shadow of a flower or fern shall fall upon it. Then with a small paint brush and some ink he may carefully paint in the shadow just as it falls upon the paper. Fig. 161 shows a dandelion, a fac-simile of a sketch made in the manner just described. Fig. 162 is an anemone. Not only can beautiful designs be made, but valuable sets of botanical sketches can be obtained in this manner, as no skill is required with the brush; all that is necessary is to follow the shadow on the paper.



FIG. 162.—Shadow cast by an Anemone.

A wooden frame or stretcher might be used with a candle or lamp at night. By tacking the paper over the stretcher, then placing a pot or vase containing plants in front of the light and the stretcher in front of the plants, the shadows of the plants

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will be thrown upon the paper and show through, so that they can be painted upon the opposite side of the paper without any danger of moving either the light or plants.

At most of the artists' material stores in New York there is to be found for sale a sensitive paper which changes color when exposed to the light. If a shadow be cast upon this paper by

some object between it and the sunlight, the paper will grow lighter in color all around the shadow, and in a few moments the shadow is marked distinctly by the difference in tints. At this stage the paper, which is of a dark blue color, may be removed, and if it be held under a stream of water the parts that were covered by the shadow will become white and remain so. I have before me a photograph of a large dragon-fly, which shows all the beautiful network of veins in the wings of that insect traced in the most delicate white lines upon a background of dark blue. I allowed the dragon-fly to rest for a few moments upon a piece of sensitive paper and then quickly placed the paper under a hydrant, with the result described.

Photographic paper is not expensive, quite a large sized sheet costing only fifty cents. Many pretty experiments can be tried with this material.

How to Enlarge or Reduce by Squares.

Suppose you have a picture of a horse and want to enlarge it. First draw a line under its feet, and at right angles with this line draw another line in front of the horse's head; divide these lines into equal parts and then carefully rule lines across from these points so as to intersect each other at right angles, as illustrated by Fig. 163. When the horse is all enclosed in squares, take another piece of paper and make exactly the same number of large squares on the paper as there are smaller ones on the horse picture; number the squares on both as in

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the diagrams (Fig. 163). If you will look at the top diagram you will see that the horse's head cuts off one corner of the upper left hand corner square; with your pencil make a line cutting off the same part of the corresponding large square; curve the line like the copy. By again referring to the horse

picture you will notice that the line of the neck continued strikes exactly at the intersection of the lines 1 and 2; draw it so. The next point the line touches just above is the intersection of the lines 2 and 3; from this point the line of the back runs

almost straight to the point on the tail at the intersection of the lines 2 and 6; thus, by finding and connecting the points of intersection you may reproduce the whole horse as illustrated by the diagram. In a similar manner a landscape, figure piece or a plan can be accurately enlarged by a boy who may have little or no talent for drawing,

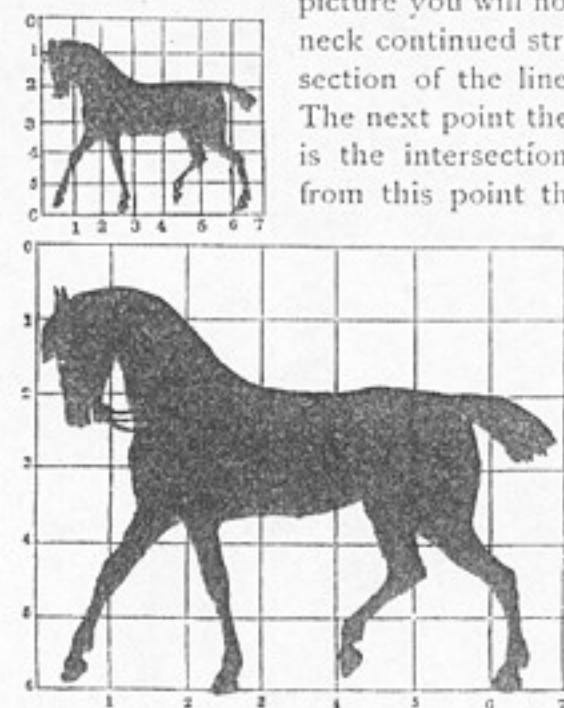


FIG. 163.—Enlargement by Squares.

but who for some purpose wishes to reproduce a picture or plan. By making the squares on your drawing-paper exactly the same size as those upon the picture, you can draw a fac-simile of the picture, and by making the squares smaller you may reduce a picture. Remember these hints, for when I tell you how to make a puppet show, although a pattern for each puppet is drawn, there is not space in a book of this size to make all

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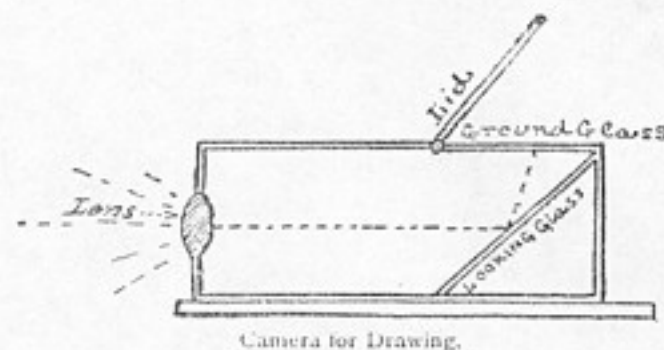
the puppets large enough, and many or all may have to be enlarged.

How to Make a Camera for Drawing.

This instrument necessitates an outlay of from fifty cents to a dollar and a half for a lens; unless the reader is fortunate enough to already possess a double convex lens, or what is known among boys as a "burning-glass." A small mirror or piece of looking-glass, a small pane of common window glass,

and an old soap or candle box, or some piece of lumber of which to make a box, is all the material required.

Let the box be about eighteen inches



long, nine inches deep, and twelve inches wide; fasten the lens in a hole cut for that purpose at one end of the box. A piece of looking-glass must be fixed at an angle of forty-five degrees at the opposite end of the box. The angle may be obtained in this manner: if from where the top of the glass rests against the end board, it measures nine inches to the bottom of the box, then the bottom of the glass should be nine inches from the end of the box.

Grind the surface of one side of the window-pane glass by rubbing it upon a flat stone or sand-paper. Make a lid to the top of the box, as shown in the illustration, and under the lid fasten the ground glass. Paint or blacken the inside of the box, and adjust the parts by experiment, so that when the lens is

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turned toward any object, that object will be immediately reflected upon the piece of ground glass. No great difficulty need be anticipated by any one in the adjustment of the parts of a camera obscura, as it can be easily arrived at by trial.

If a piece of drawing-paper be placed over the ground glass, and the lens turned toward some object, that object will be reflected upon the glass and shown through the paper in all its natural colors, strong enough to be accurately traced and reproduced.

In this manner considerable amusement and instruction can be derived from a home-made camera obscura.

If one of these instruments be taken into a darkened room, and the lens allowed to point out through the window, everything that passes the house will be reflected upon the ground glass, making a sort of moving, colored, puppet show.

Winter.

CHAPTER XXVII.

SNOWBALL WARFARE.

How to Build Snow-Forts—How to Make Shields and Ammunition Sleds.

COLD gray clouds have long since usurped the heavens and



FIG. 164.—Snow-Fort commenced.



driven away the white, fleecy summer cumulus; the latter, like the birds, have gone to more congenial climes. For several weeks past heavy overcoats have been in demand.

The rowing season has closed; the baseball bats and lawn tennis rackets are stowed away, and the college boys have settled down to study and in-door gymnasium practice.

In the cities the car and stage drivers swing their arms about and beat their muffled chests in a vain effort to start the blood to circulating in their benumbed fingers. Each passenger, as he reads the morning paper, exhales two streams of mist from his nostrils. The horses puff larger streams of

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steam and wear chest protectors. Everybody appears unhappy except the school-boy. The latter's cheeks glow with more than usual color and his eyes sparkle as if with inward merriment, for *he knows the signs*, and the dull, leaden sky to him is only a promise of a big snow storm and "lots of fun." The frost king has arrived and introduced jolly old Winter. Every boy knows that no season of the year can boast of more healthy out-door games, brimful of fun and excitement, than winter, and that there is no sport among winter games more exciting and amusing than snowball warfare. The interest and fun of the game is greatly enhanced if there be a fort to capture or defend.

How to Build the Fort.

All the boys must join in building the fort, selecting the highest point of the play-grounds, or, if the grounds be level, the corner of a wall or fence. Supposing the top of a mound

has been selected as the place where the works are to be built, the first thing to do is to make out the plan of the foundation. The dimensions depend upon the number of boys. A circle twelve feet in diameter, or a square with sides of ten feet, will make a fort that will accommodate a company of ten boys. It is better to have the fort too small than too large. The chief engineer must set his men to rolling large snowballs; the smaller boys can commence them and the larger ones take the balls in hand when they have gained in size and become too heavy for the younger boys.

Make these balls of snow as large and dense as possible; then roll them in place upon the lines traced out for the foundation. We will suppose it to be a square. In this case, care must be taken to have the corners of the square opposite the most probable approach of the enemy. This will leave the smallest point possible exposed to the attack, and the inmates

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of the fort can, without crowding each other, take good aim at the foe. After the four sides of the square are covered by large snowballs, as in Fig. 164, all hands must pack the snow about the bottom and fill up each crack and crevice until a solid wall is formed. Then with spades and shovels the walls should be trimmed down to a perpendicular on the inside, but slanting upon the outside, as shown in Fig. 165. The top of the wall may be two feet broad and the base four feet. When

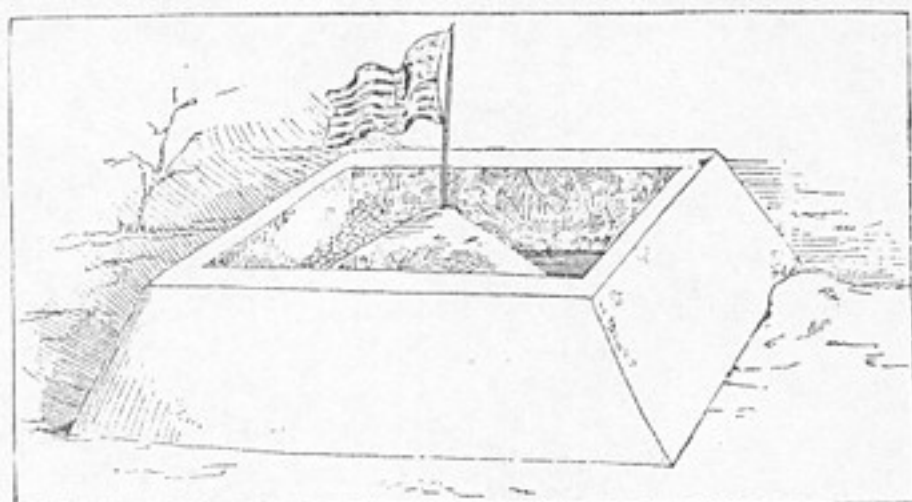


FIG. 165.—Snow Fort finished.

the wall is finished, prepare a mound of snow in the centre of the square for the flag-staff. This mound will be very useful as a reserve supply in case the ammunition gives out. A quantity of snowballs should next be piled up, inside the walls, at the four corners. This done, the fort is ready for its defenders, and it only remains to equip the attacking force.

The building of a fort generally uses up all the snow around it, making it necessary for the besieging party to carry their ammunition with them upon sleds made for that purpose.

The construction of these sleds is very simple, the materials

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and tools necessary consisting of a flour-barrel, a saw, a hatchet, some shingle nails and an old pine board.

How to Make an Ammunition Sled.

To make the sled, begin by knocking the barrel apart, being careful not to split the head-boards, as they will be needed afterward. Pick out the four best staves, as nearly alike in breadth and curve as can be found, and saw two or three of the other staves in halves. Take two of the four staves first se-

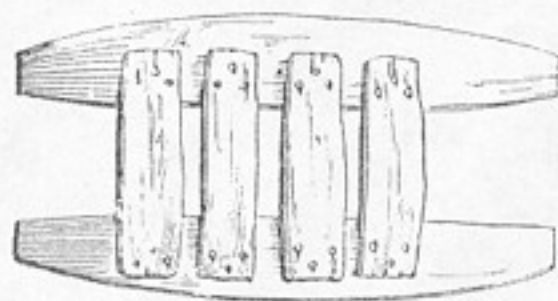


FIG. 166.—Top of Ammunition Sled.

is to be driven, otherwise the spring of the stave, when struck, will throw the nail out, and your fingers will probably receive the blow from the hammer. To avoid this, place a block, or anything that is firm, under the point where the nail is to be driven, and there will then be found no difficulty in driving the nails home. When this is done you will have the top of your sled as shown in Fig. 166; on this you will need a box or bed to hold the snowballs; this you can make of two pieces of pine board and two staves, thus: Take a board about the same width as, or a little wider than, a barrel-stave; saw off two pieces equal in length to the width of the sled; set them upon their edges, reversing the top of the sled; place it across the two boards and nail it on securely. Then take two staves

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and nail them on for side boards, and you have the top portion of your sled finished.

The two staves remaining of the four first selected are for runners. Fit on first one and then the other to the staves of the top. Nail-holes will probably be found near the ends of the staves where the nails were that held the barrel-head in;

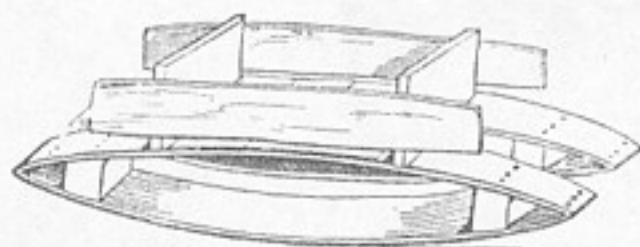


FIG. 167.—Ammunition Sled finished.

through these drive nails to fasten your runners; to do this you must rest them upon some support, as was done before; this will hold your sled together, but to make it stronger take four wedge-shaped blocks of wood and slide them in between the runners and the top, as shown in Fig. 167, and nail these firmly in place from above and below.

If all this has been properly done, you now have made a sled which it will be almost impossible to break; and, with a rope to pull by, one boy can haul snowballs enough for a dozen companions.

How to Make the Shield.

The shield is made from the head of a barrel. Lay the barrel-head upon some level surface, so that nails can be driven in without trouble.

From a strip of board half inch thick and two and one-half inches wide saw off two pieces long enough to fasten the parts of the barrel-head together, as you see them in Fig. 168. Fasten these strips on firmly with shingle nails.

Lay your left arm upon the shield, as shown, mark a place for the arm-strap just in front of elbow, and another for the

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strap for the hand. From an old trunk-strap, or suitable piece of leather, cut two strips and nail them on your shield at points

marked, being careful that the arm-strap is not too tight, as it

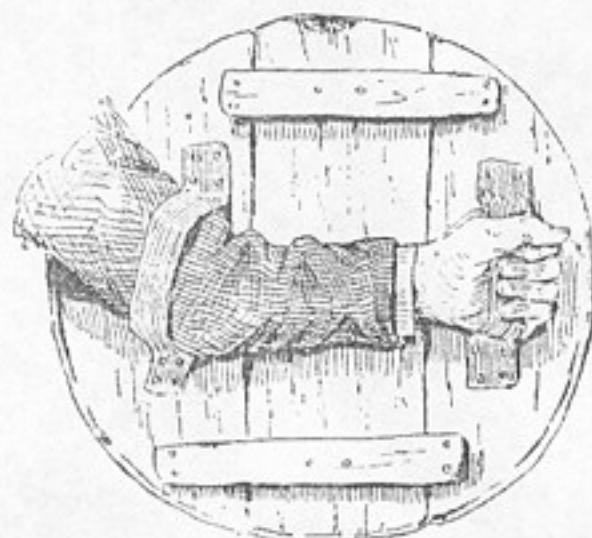


FIG. 168.

should be loose enough for the arm to slip in and out with ease. This done, you have a shield behind which you may defy an army of unprotected boys.

Rules of the Game.

The rules of warfare governing a snowball battle are as follows:

Two commanders, or captains, must be elected. If the forces engaged be very large, each captain may appoint one or two assistants, or lieutenants. These officers, after being elected and appointed, are to give all orders, and should be promptly obeyed by their respective commands. The captains decide, by lot, the choice of position.

In choosing sides, the captain who is commander of the fort has first choice, then the two captains name a boy, alternately, until two-thirds of the boys have been chosen. The defenders of the fort then retire to their stronghold, leaving the boys unchosen to join the attacking army, it being supposed that one-third behind fortifications are equal to two-thirds outside.

Only the attacking party is allowed shields and ammunition sleds.

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At least thirty yards from the fort a camp must be established by the outsiders or attacking army, and stakes driven at the four corners to locate the camp. Imaginary lines from stake to stake mark its limits.

Each party will have its national colors, in addition to which the attacking party has a battle-flag which it carries with it in the assault.

The defenders of the fort must see to it that all damages to the fortifications are promptly repaired.

Any soldier from the fort who shall be carried off within the limits of the camp becomes a prisoner of war, and cannot leave the camp until rescued by his own comrades.

Any one of the attacking force pulled into the fort becomes a prisoner of war, and must remain in the fort until it is captured.

Prisoners of war cannot be made to fight against their own side, but they may be employed in making snowballs or repairing damages to fortifications.

Any deserter recaptured must suffer the penalty of having his face washed with snow, and being made to work with the prisoners of war.

When the outsiders, or attacking army, can replace the enemy's colors with their battle-flag, the fort is captured and the battle is won by the attacking party; all fighting must then immediately cease.

But if, in a sally, or, by any means, the soldiers of the fort can take the colors of the opposite party from the camp and bring them inside their fortifications, they have not only successfully defended their fort, but have defeated the attacking

army; and this ends the battle, with double honors to the brave defenders.

No water-soaked or icy snow-balls are allowed. No honorable boy uses them, and any one caught in the ungentlemanly

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act of throwing such "soakers" should be forever ruled out of the game.

No blows are allowed to be struck by the hand, or by anything but the regulation snowball, and, of course, no kicking is permitted.

The following sketch of a snow battle in which the author took part when a boy, will give an idea of the excitement and interest of the game:

A Snow Battle.

It was a year when the Indian summer had been prolonged into the winter. Christmas had come and gone and a new year begun, but not one flake of snow had fallen on the river bank or neighboring hills.

Such was the condition of things one January morning in a Kentucky town upon the banks of the Ohio River, where myself and some sixty other boys were gathered in a little frame school-house.

We had about made up our minds that old Jack Frost was a humbug, and winter a myth; but when the bell tapped for recess, the first boy out gave a shout which passed from mouth to mouth until it became a universal cheer as we reached the play-grounds, for floating airily down from a dull, leaden, gray sky came hundreds of white snow-flakes!

Winter had come! Jack Frost was no longer a humbug! Before the bell again recalled us to our study the ground was whitened with snow, and the school divided into two opposing armies. That night was a busy one—all hands set to work manufacturing ammunition sleds and shields for the coming battle. It was my fortune to be chosen as one of the garrison of the fort. There was not a boy late next morning—in fact, when the teachers arrived to open the school, they found all the scholars upon the play-grounds, rolling huge snowballs. All

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night the snow had continued to fall, and it was now quite deep. When we went out at noon a beautifully modelled fort of snowy whiteness stood ready for us, and from a mound in the centre floated the battle-flag.

Our company took their places inside the fortifications.

We could see the enemy gathered around their captain at their camp some two hundred yards distant, their ammunition sleds loaded with well-made snowballs. The lieutenant bore their battle-flag.

Our teachers showed their interest by standing shivering with wet feet in the deep snow to watch the battle. At a blast from a tin horn on rushed the foe! They separated and came in two divisions, approaching us from the left and right.

"Now, boys," cried our captain, "be careful not to throw a ball until they are within range."

Then, calling the pluckiest among us, a flaxen-haired country boy, to his side, he whispered a word or two and pointed to the flag in the enemy's camp. The boy, who had been nicknamed "Daddy" on account of his old-looking face, slipped quietly over the rear wall of the fort, dodged behind a snow-drift and then behind a fence, and was lost to sight. For-

ward marched the enemy, their battle-flag borne in advance of the party to the right. Their captain was at the head of the division to the left.

Having engaged our attention on the two flanks, where we stood ready to receive them, as they neared us, by a quick and well-executed manœuvre, rushing obliquely toward each other, the two divisions unexpectedly joined, and advanced, shield to shield, with the ammunition sleds in the rear. It was in vain we pelted them with snowballs; on they came, encouraged by a cheer from the teachers and some spectators who by this time had gathered near the school-house.

Three times had our noble captain been tumbled from his

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perch upon the mound in the centre of the fort, when another burst of applause from the spectators announced some new development, and as we looked, we could see "Daddy" with the colors of the enemy's camp in his arms, his tow hair flying in the wind as he ran for dear life.

In an instant the line of the enemy was all in confusion; some ran to head off "Daddy," while others in their excitement stood and shouted. It was our turn now, and we pelted their broken ranks with snow until they looked like animated snow-men. Another shout, and we looked around to find our captain down and the hands of one of the besieging party almost upon our flag. It was the work of a second to pitch the intruder upon his back outside the fort. Then came the tug-of-war. A rush was made to capture our standard, several of our boys were pulled out of the fort and taken prisoners, and the capture of the fort seemed inevitable. Again and again a number of the enemy, among whom was their color-bearer, gained the top of our breastworks, and again and again were they tumbled off amid a shower of snowballs that forced them to retire to gain breath and clear their eyes from the snow. Once their lieutenant, with the red-bordered battle-flag, had actually succeeded in reaching the mound upon which stood our colors, when a combined attack that nearly resulted in his being made prisoner drove him from the fort to gather strength for another rush. "Daddy" was now a prisoner, and the recaptured flag again floated over the enemy's camp, when the school-bell called us, fresh and glowing with exercise and healthful excitement, to our lessons. The battle was left undecided, but our fort was soon captured by a force stronger than any our companions were able to bring against it, for a warm south wind sprang up from the lowlands down the river, and our fortification quickly yielded to its insidious attack, and the snow campaign was over.

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How to Bind a Prisoner Without a Cord.

A gentleman who was much interested in the foregoing description of snowball warfare sends a sketch of the manner he and his playmates used to bind their prisoners taken in snow battles. The captive was taken to a post or smooth-trunked sapling and compelled to put his arms and legs around it as if he were about to climb. The right leg crossed the left leg, and the toe of the right shoe was pushed behind the post or tree trunk in the position shown by the illustration.

After taking this position the prisoner was gently pushed down into a sitting position. It is next to impossible for a person so fixed to arise without help. The toe of the left shoe binds the right leg; the toe of the right shoe binds the post, and the arms can be only used to hold on by. When a friend reaches the captive he takes him by the arms and lifts him up. As soon as the prisoner assumes an upright position he can free himself without difficulty.



A Prisoner of War.

Company Rest.

The same gentleman who sent the above ingenious device also tells of some funny manoeuvres the boys used to go through. For instance, during a lull in the battle, the commander would call out "Company rest!" One man then assumed a stooping position; the next man sat on the right

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knee of the first man; a third man would sit upon the right knee of the second man and so on until a circle was formed, each fellow sitting in some other fellow's lap and yet no one sitting upon anything else. "Thus," says the correspondent, "we all were enabled to sit down without using the damp snow for a camp stool."



"Advance under Fire."

CHAPTER XXVIII.

SNOW-HOUSES AND STATUARY.

IN "the land of the midnight sun," the far arctic regions where Jack Frost rules supreme, where the glistening ice and thickly packed snow covers the landscape almost the whole year round, the hardy inhabitants live in huts built of frozen blocks of snow. The interior of these icy dwellings are not, as might be supposed, uncomfortably cold, but, on the contrary,

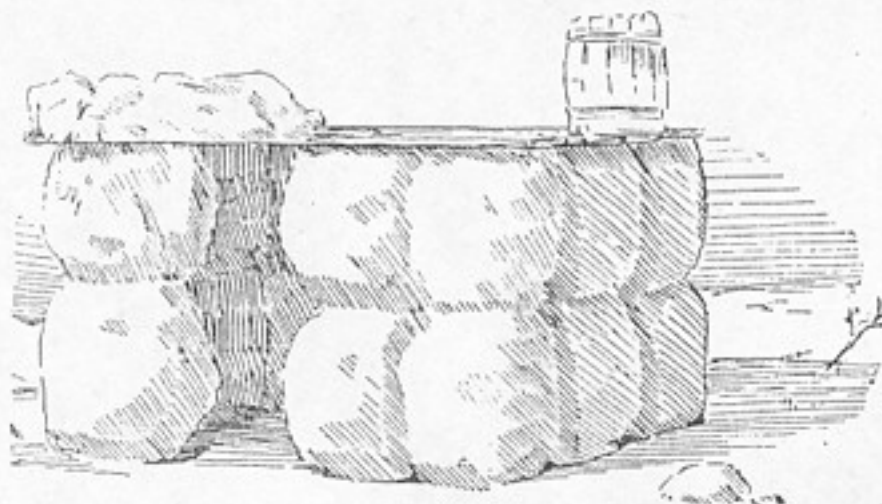


FIG. 169.—Showing the construction of a Snow-House.

are quite warm and cosy. Boys who are inclined to doubt this may make the experiment for themselves. After the first good old-fashioned snow storm has covered the play-ground, roads, and house-tops, and while the merry jingle of the sleigh-

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bells tinkles through the wintry air let them busy themselves rolling huge balls of snow after the manner described in the chapter on "Snowball Warfare," making the foundation of

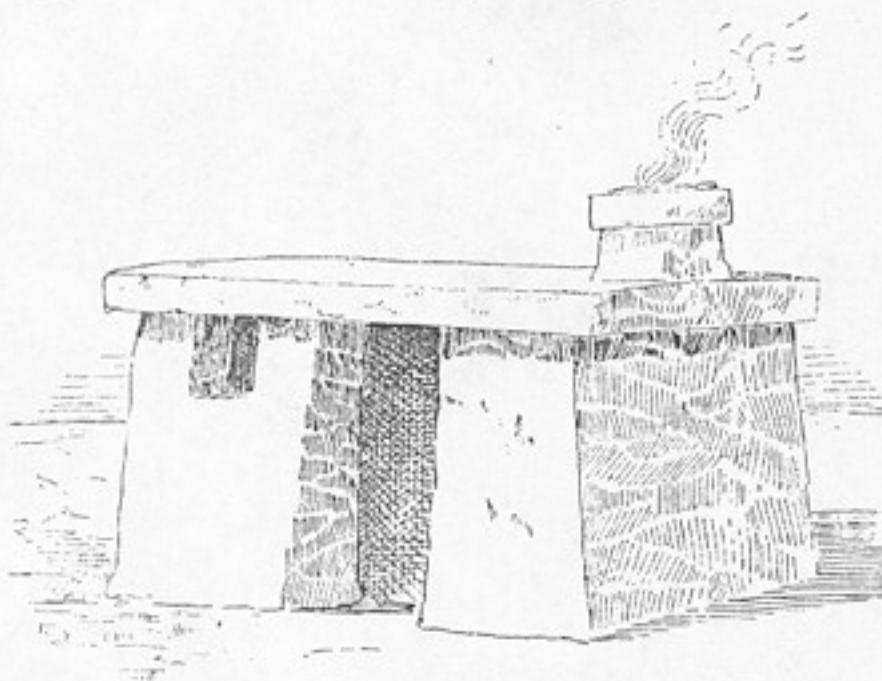


FIG. 170.—A Snow-House Finished.

the house exactly in the same way as that described for the snow-fort (page 258).

The roof is made of boards or planks covered with snow. A barrel placed over a hole in the roof, and surrounded by packed snow properly shaped, will make a very good chimney. A pane of glass can be set in the square hole made for a window; a heavy piece of carpet can be hung from the ceiling over the doorway, so as to act as a curtain; or if the young work-people choose to take trouble enough, they can put up a framework inside of the door-way and hang a

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wooden door to it by leather or canvas hinges. An old stove, or a fire-place made near the wall under the chimney, adds a finish to the house that will be found quite snug and comfortable as long as the snow lasts. The fire inside, if the weather be cold, will not melt the walls. The pictures of the house (Figs. 169 and 170) show so well how it is constructed,

and how it looks when it is done, that very little explanation is necessary.

The walls are made of large snow-balls properly placed, with snow packed between them to make the surfaces tolerably even, and then the whole shaved down with a spade, outside and inside. It will be found impossible to put one tier of balls upon the top of the others by lifting them in place, but this difficulty may be overcome by sliding the balls up an inclined plane made of a strong plank, one end of which must be placed upon the ground and the other allowed to rest upon the top of the first or foundation row of snowballs.



FIG. 171.—Making the Pig.

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Snow Statuary.

The statuary may be of various kinds. It is very seldom

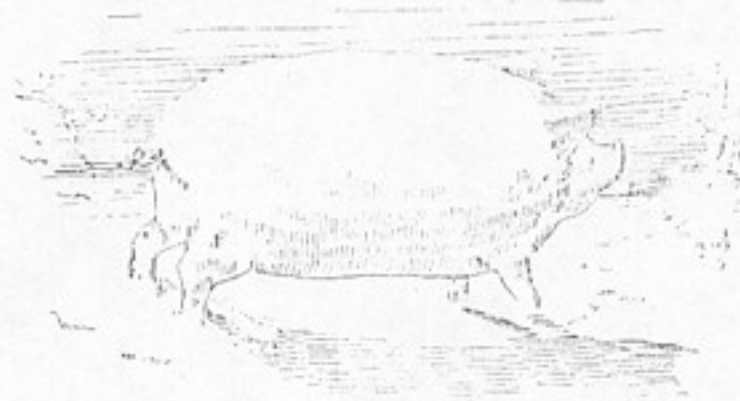


FIG. 172.—A Snow Pig.

that pigs are sculptured in marble or cast in bronze, and it would be well to make some of snow, so as to have statues not likely to be found elsewhere. An oblong mass of snow forms the body (Fig. 171); the legs, nose, and ears are made of sticks surrounded by snow, and a bit of rope nicely curled will make a very good tail. The various parts



FIG. 173.—Making "Frenchy."

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can be shaped and carved according to the skill of the young artist. A number of pigs, of different sizes, will give a lively and social air to the yard of a snow-house. Fig. 172 shows a finished pig.

A statue of a Frenchman in an ulster is also rather uncommon, and is not hard to make. The foundation of the body, head, and legs consists of several large snowballs, as seen in Fig. 173, and the arms are made of smaller balls stuck on two sticks, which are inserted in the body at proper angles. When the whole figure has been "blocked out," as the artists say, it must be carved, with broad wooden knives or shingles,



FIG. 174.—Frenchy in his Ulster.

into the proper shape, as shown in Fig. 174. The moustache should be made of icicles, which may be stuck in the face.

Arctic owls, which are very large and white, can also be made of snow, in the manner shown in the adjoining pic-



FIG. 175.—Carving the Owl.

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ture. These figures can be placed on snow pedestals if they are small, but if they are monster owls, like those in the illustrations (Figs. 175 and 176), they must be placed upon the ground.

In either position, if they are fashioned properly, they will look very wise and respectable.

When the snow is too dry to make a snowball it cannot be used to make statuary, but after a slight thaw or a fresh fall of snow it readily adheres upon a slight pressure, and can be formed or fashioned in almost any shape.

Many curious objects and figures may be carved out of solidly packed balls of snow. A lawn covered with a number of large snow figures presents a most grotesque appearance, and is sure to attract the attention of all passers-by. With practice not a little skill may be acquired by the young sculptor, and if the statuary be made of large proportions, they will sometimes last for weeks after the snow has disappeared from the ground and house-tops.



FIG. 176.—An Arctic Owl.

CHAPTER XXIX.

SLEDS, CHAIR-SLEIGHS, AND SNOW-SHOES.

THE construction of one of the simplest sleds is shown by Fig. 177; it consists of nothing more nor less than three pieces of board nailed upon two barrel-staves. The barrel-stave sled possesses the advantage of being so simple in design that a child might make one, and although this primitive sled can lay claim to neither grace nor beauty, it will be found useful in a variety of ways; it may be used for coasting, or for transporting loads of snow when building snow houses, forts or figures.



FIG. 177.—Barrel-stave Sled.

If, instead of the long top board, a kitchen chair be fitted on, as shown in Fig. 178,



FIG. 178.—A Chair-Sleigh.

Any boy who is fortunate enough to have a mother or sister who takes sufficient interest, and has the time to accompany him on his skating trips, will find a chair-sleigh quite a handy thing to possess, and when he moves from one part of

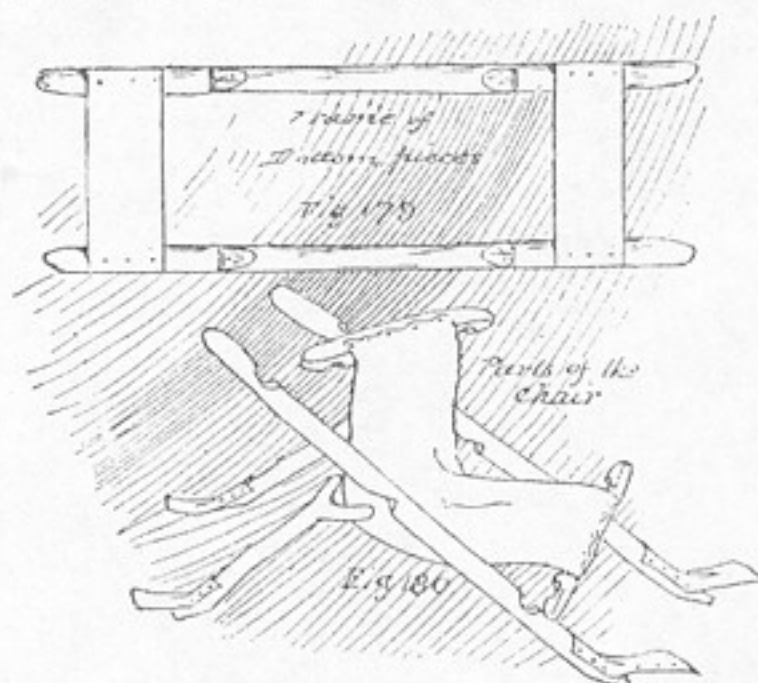
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the ice to a distant portion of the pond or river he can skate behind the sleigh with his hands upon the back of the chair, and push his lady friend rapidly over the ice, adding much to her enjoyment as well as his own.

The cumbersome wooden kitchen chair is heavy to carry if the skating pond be far from home, but a

Folding Chair-Sleigh

may be made from a few sticks and pieces of leather for hinges. This chair is made upon the same principle as the one described



FIGS. 179 and 180.—Parts of Folding Chair.

in the chapter devoted to, "How to Camp Out." Figs. 179 and 180 show all the parts in detail as they would look before being joined together. The seat may be made of a piece of carpet, canvas, or any strong material, the hinges of leather. Fig.

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181 shows the chair after it has been put together. The runners consist of skates, which may be strapped on or taken off at pleasure, without injuring the skates in the least. If the chair is to be carried it can be fold-

ed up. When the chair frame is lifted the forked sticks that support it will slip from the notches in the side bars and fall on to the runner bars; the chair

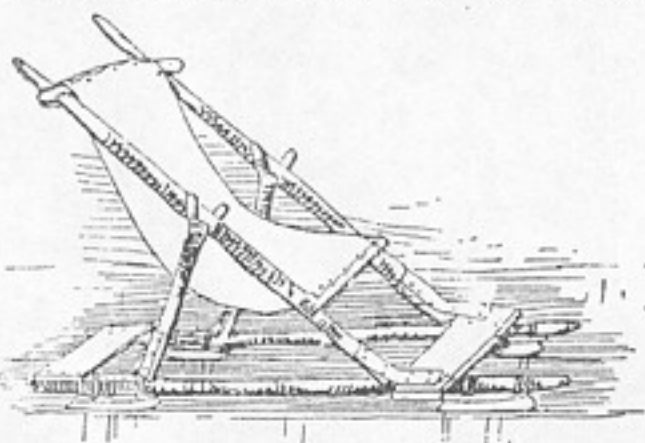


FIG. 181.—Folding Chair-Sleigh Ready for Use.

frame can then be let down and the whole frame-work will form a flat, compact mass (Fig. 182), that can be easily carried by quite a small boy. By using light sticks, regular metal hinges, and a prettily worked cloth for the seat, a very light and beautiful chair-sleigh can be made that, with the skates removed, will make an ornamental parlor chair for summer, and when the ice again covers the surface of the water, it will be only necessary to strap on the skates, and the easy chair becomes trans-



FIG. 182.—Folded Up.

formed into a chair-sleigh, to be pushed about over the glittering ice wherever its occupant may direct or the whim of the boy who forms the motive power may take him.

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The Toboggan.

This sled, familiar to all who visit Canada or the Provinces during the winter months, is more like a mammoth snow-shoe than the ordinary sled, sleigh or jumper that we are accustomed to see. It is suitable for the deep snow and heavy drifts of the northern countries, where the runners of a common sleigh



FIG. 183.—The Toboggan.

would be liable to break through the crust and bury themselves, thus impeding, if not altogether stopping, the vehicle. The toboggan presents a broad, smooth bottom to the snow, and glides over the crust.

To make one of these sleds you must procure two pieces of quarter-inch pine lumber eight or ten feet long and one foot wide. Place the two boards side by side and join them together by the means of round cross sticks; the latter are bound to the bottom board by thongs; the thongs pass through holes in the bottom boards on each side of the cross stick, and are made fast by a series of "hammock hitches" (see page 80. and Fig. 159, E). Where the thongs pass underneath the bottom

board grooves are cut deep enough to prevent the cord from projecting; the grooves are quite necessary, for if the cords were allowed to project beyond the surface of the boards they would not only impede the progress of the toboggan, but the friction would soon wear out the thongs and the sled would come apart. On top of the cross sticks two side bars are lashed;

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the front ends of the board are then curled over and held in position by two thongs made fast to the ends. Fig. 183 shows a finished toboggan drawn from one manufactured by the Indians in Canada.

Snow-Shoes or Skates.

The Norwegian ski is a snow-shoe, or rather a snow-skate, nine feet long, used by the Norwegians to glide down the mountains or hillsides when the latter are covered with snow.

Great fun can be had with a pair of snow-shoes made on the same principle as the Norwegian skate shoe, and it is little trouble to manufacture a pair from two barrel staves.

After selecting a couple of straight-grained staves, score

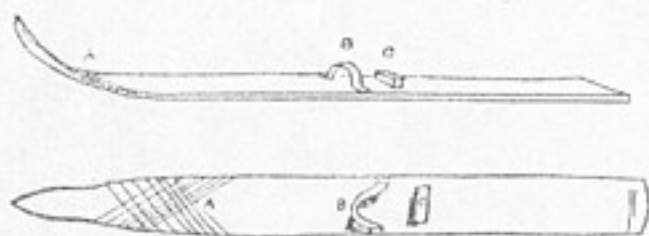


FIG. 184.—Top and Side View of Barrel-stave Skate.

one end of each stave with grooves cut in the wood either with your knife or a small gouge, as shown by the lines at A, Fig. 184. Smear the end thickly with grease and hold it near a hot fire until you find that it can be bent into the form shown by the diagram (Fig. 184); bind it in position by a cord and let it remain so until the wood retains the curve imparted. Make two blocks, each one inch broad and high enough to fit under the heels of your shoes; fasten the blocks on to the snow-skates by screws (C, Fig. 184); at a proper distance in front of the block fasten two straps securely (B, Fig. 184). By slipping the toes of your shoes through the straps and allowing the hollow of the foot to rest over the blocks C, C, so that the

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heels of your shoes bear against the blocks, you can keep the shoes on your feet, and, with the aid of a stick to steer by, go sliding down the coasting hill among the sleds and jumpers, creating as much fun for the others in your first attempts as you do for yourself; but with practice skill can be acquired in the use of snow-skates.

CHAPTER XXX.

HOW TO MAKE THE TOM THUMB ICE-BOAT AND LARGER CRAFT.

ALTHOUGH a full-rigged, delicately balanced ice-yacht looks like a very complicated piece of mechanism, when it is carefully examined the framework will be found to consist of two pieces crossing each other at right angles. The top of the cross is the bowsprit, the bottom of the cross the stern, and the sides the runners. At the intersection of the cross pieces the mast is stepped. The principle is simple enough,

and with some sticks, two small pieces of inch lumber, three old skates, and two boards, a real little "Tom Thumb ice-yacht" can be built to hold a crew of one, and to be rigged like a catboat or with a jib and mainsail. The cross board may be made about 3 feet long and 6 inches wide. Make two runner blocks

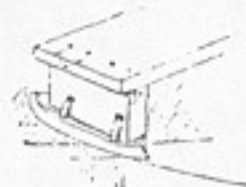


FIG. 185.—End of Cross-board, showing Runner-block and Skate.

of inch lumber, and let them be each 6 inches long and 3 inches wide. With a bit and brace or a red-hot poker bore holes at proper distances apart for the straps of old-fashioned skates to pass through. One inch from each end of the cross board, fasten on the runner blocks securely with nails or screws (Fig. 185). For the centre plank use a board about 6 inches wide and 5 feet long. Nail the cross plank on to the centre plank in such a manner that a line drawn through the centre of the latter will intersect the cross board exactly at its middle. The planks must be at right angles to each other, forming a cross, the cen-

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tre piece extending about one foot beyond the cross piece; this end will be the bow of the ice-boat and the opposite end the



FIG. 186.—Rudder with Tiller-ropes.

stern. Bore a large hole in the stern for the rudder-post to pass through. The rudder-post may be made in a variety of forms; a simple and convenient one is shown by Fig. 186. Another hole must be made through the point where the centres of the cross and centre planks intersect for the mast. Fig. 187 shows a leg-of-mutton sail, but the young yachtsman

may make a sail of any description that may suit his taste. By referring back to the chapter on "How to Rig and Sail Small Boats," he can find several simple kinds of sails illustrated. Fig. 188 shows the top view of an ice-boat a trifle larger than the one just described; the braces shown in the diagram are unnecessary on very small craft. To hold the mast more securely in larger yachts, a bench is made after the plan of Fig. 189; this will prevent the mast from being carried away under any ordinary circumstances, and also prevent it from swaying with every puff of wind. Where a seat is made as in Fig.

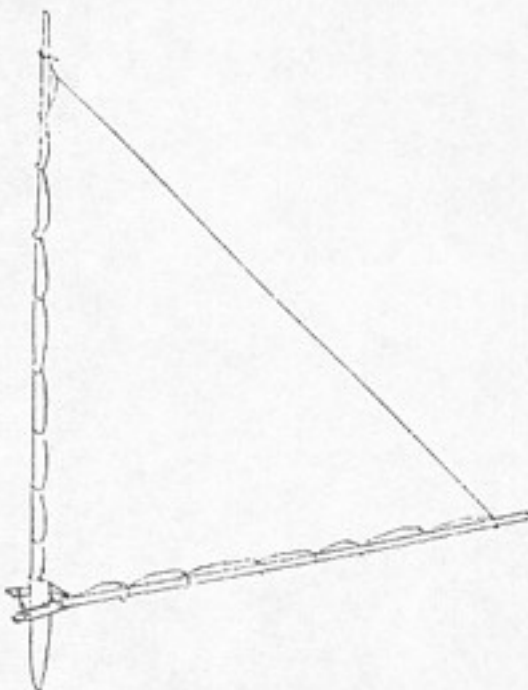


FIG. 187.—Leg-of-mutton Sail.

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188, a wooden handle can be substituted for the tiller-ropes (Fig. 190).

The rudder is made of a skate; the latter is fastened by the screw at the heel and then strapped on a board nailed on to a club, shaped like a potato-masher; the small part of the club runs through a hole in the stern of the centre-board. A forked stick can be used for a tiller and must be fastened on to the rudder-post by running a pin or large wire

through holes bored for the purpose in the rudder-post and the prongs of the forked stick. If the top of the rudder-post be squared, a tiller may be made of a stick with a square hole to fit over the end of the rudder-post, as shown in the illustration at the end of this chapter.

Perhaps some of my readers will invent more ingenious and simple steering apparatus than the ones given here; if



FIG. 189.—Mast Bench.

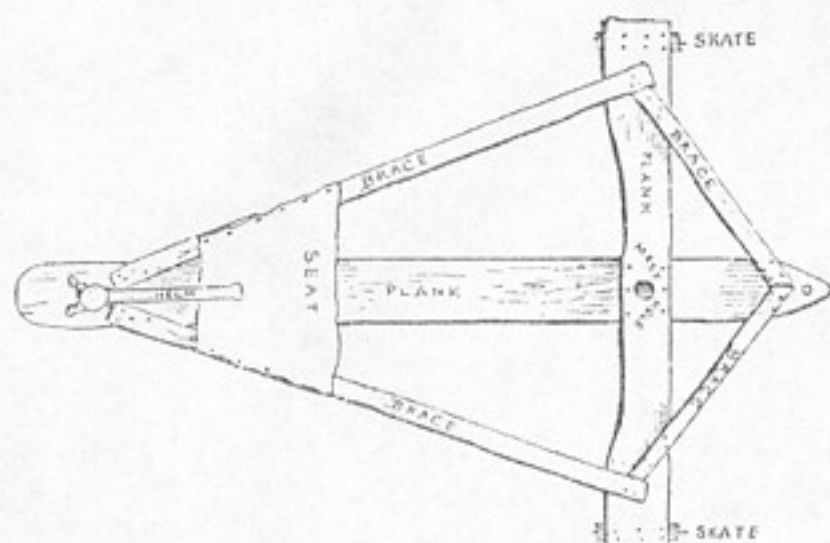


FIG. 188.—Top View of Ice-Boat.

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not, and the rudder-post and tiller seem to be a little too difficult, they may be omitted, and a stationary runner block substituted in their place. The boat must then be steered by the feet of the crew. To do this he should have on skates. If a

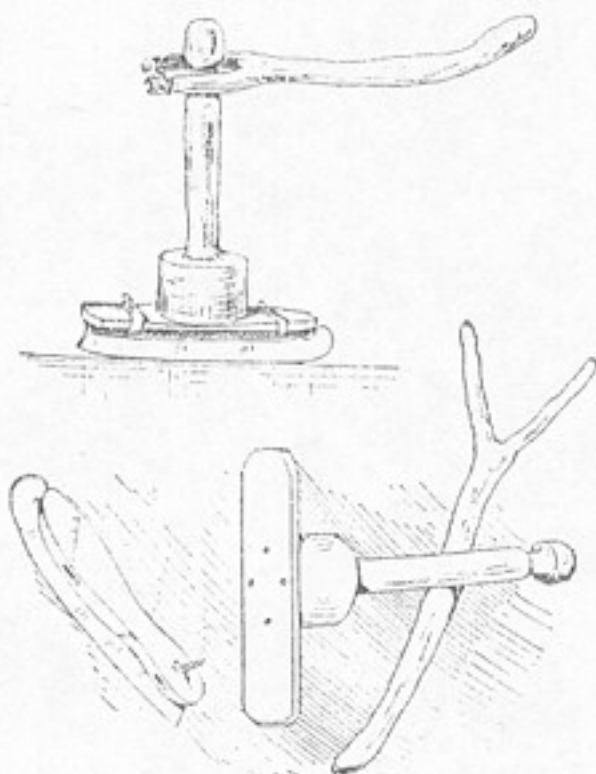


FIG. 190.—Steering Apparatus.

long handle be attached to the stern like the back to a sleigh-chair, the steersman with skates on can guide the boat with his feet by standing behind and holding on to the handle at the stern. With this rig, the boat can accommodate a passenger aboard, as the steersman does not occupy the boat itself but tends the sheets and steers while being towed behind. A

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common sled may be fixed with holes in it so that a cross board can be attached by movable pegs, and with a mast stepped in the bow it will make tolerable speed and may be steered by a boy on skates.



A Tom Thumb and Crew.

CHAPTER XXXI.

THE WINGED SKATERS, AND HOW TO MAKE THE WINGS.

SKIMMING over the glassy surface of an ice-bound river or pond, propelled by the wintry blast blowing against artificial wings of cloth, is but a degree removed from flying. The friction of your skate runners upon the ice is so slight that it is not difficult to imagine that you have left the earth and are soaring in mid-air.

Every boy who has had any skating experience knows what hard work it is to skate against a stiff wind, and almost all who ever fastened skates to their feet must have enjoyed the luxury of sailing over the ice before the wind with a spread coat or open umbrella doing duty as a sail.

For some time back people in widely separated parts of the world have made more or less successful attempts at transforming themselves into animated ice-yachts, and in Canada, Norway, and other cold countries, men with sails rigged on their backs or shoulders have "tacked," "come about," and "luffed" themselves in a novel and highly entertaining style, but lately, for some reason or other, this sport has been allowed to almost die out, and we are now indebted to two or three writers for reintroducing skate-sailing to the public with original suggestions and improvements. Mr. Charles L. Norton, editor of *The American Canoeist*, was, I believe, the first to call the

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attention of the public in general, and the boys particularly, to this delightful sport. In an article published in the *St. Nicholas Magazine*, entitled "Every Boy his Own Ice-Boat," Mr. Norton describes a new and original device, consisting of a

double sail, which is so simple in construction, and yet so strong, light, and easy to manage, that it is sure to become a favorite rig with the boys, both large and small.

In another article entitled "White Wings," which appeared in *Harper's Weekly*, the same author describes a number of queer sails used by different people. Following in the footsteps of Mr. Norton, and adding to our information on this subject, comes T. F. Hammer with an interesting article published in the *Century Magazine*, in which this gentleman gives some personal experience as a winged skater and a detailed description of the Danish skate-sail.

Among the many reasons given by skate-sailors why this new and highly exhilarating pastime should come into general favor are these: skate-sailing can be practised and enjoyed on ice too rough for ordinary skating, and a light fall of snow that ruins the ice for the common skater improves it for the winged yachtsman.

Salt-water ice that is too soft for one to enjoy a skate upon affords a better foothold than smooth, hard, fresh-water ice, and is preferable on that account. Wherever you can skate there you may sail, and when the skating proper is ruined, it often happens that the qualities of the ice are improved for sailing. There is no record of a serious accident happening to any skate-sailor, although one may attain, literally, the speed of the wind, the higher the rate of speed the less danger there appears to be, for in falling a person will strike the ice at such an angle that he is merely sent sliding over the surface, and little or no damage is done.

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Bat Wings.

After procuring a suitable piece of cloth, spread it out upon the floor and tack it there, then spread yourself out on the cloth with your arms extended at right angles to your body, and your feet spread apart. While in that position, have some one mark on the cloth the points where the crown of your head, your wrists, and ankles come. With a chalk or pencil connect these points by lines, and, allowing for the hem, cut the sail out according to the pattern made.

Turn the edges over and make a strong broad hem all around the sail, sew in straps or bands at the ankle, waist, wrists, and head. When the sail is to be used, adjust the head-band around the forehead, fasten the waist, wrist, and ankle straps, and the ship is rigged. By spreading the arms, the sail is set; when the arms are folded the sail is furled. It would become exceedingly tiresome to hold the arms outstretched from the sides for any length of time without support; to obviate this, a stick may be carried, which, when thrust behind the back, will make a support for the hands as they grasp it near the ends. The man-bat steers with his feet, using his legs and arms for sheet-lines. Skaters rigged up in this novel style present a most grotesque appearance as they flap their wings about in going through various evolutions.

The Norton Rig

is a double sail, and might be called a schooner rig. It is in many respects superior to the somewhat cumbersome single sails, the chief advantage being the fact that the crew can see in every direction, and thus avoid running foul of any other craft or skater. Another improvement is the double main spar which, without increasing the weight, affords a stronger support for the cross pieces, or fore and main masts. The main

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spar may be made of spruce pine or bamboo. Cane fishing-poles are inexpensive, and can probably be readily obtained by most boys. Select two pieces, each about ten feet long, and bind the butt or large end of one to the small end of the other; lash the other ends firmly together in like manner, so that the two poles will lay side by side firmly bound at each end.

For the fore and main masts or cross yards, Mr. Norton recommends bamboo, five-eighths of an inch in diameter, but American cane will also answer for that purpose. Pick out two pieces five-eighths of an inch in diameter at the smallest ends,

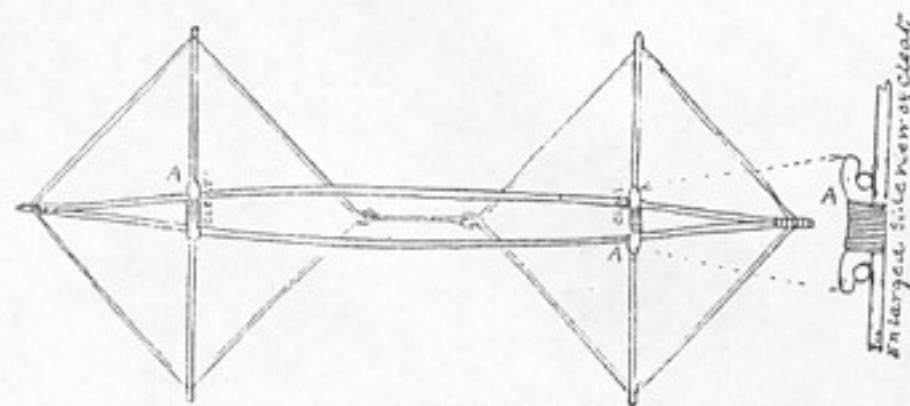


FIG. 191.—The Norton Rig.

and let each be four feet six inches long. Near the ends of the cross yards fasten metal buttons or knobs, and fasten similar knobs near the ends of the main spar. Make a small cleat for the middle of each cross spar (A, A, A, Fig. 191) and lash it firmly on.

Make the sails of the heaviest cotton sheeting, if it can be procured; if not, take ordinary sheeting and double it, or what cloth you can procure. Mark out the sails, making allowance for the hem, and let them measure four feet across the diagonal after the hem has been turned down; bind the sails with strong tape, and see that the corners particularly are made very strong.

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Sew to the "clews" or corners small metal rings, or loops of strong cord, to fasten on the buttons at the ends of the spars.

Attach the sails to the cross spars by slipping the rings at the clews over the buttons at each end of the spars. Spring the main spar apart and slip the cleats of the cross spar between the two pieces, so that they fit as shown by Fig. 191. Fasten the outside clews to the buttons on the ends of the main spar and bind the two inside clews tightly together with a cord as shown in the diagram, and you are all ready to give the novel device a trial. Go to the nearest sheet of ice, put on your skates, and after seeing that they are securely fastened, take up the sails and let yourself go before the wind, steering with your feet. After practising awhile you can learn to tack, and go through all the manoeuvres of a regular sail-boat.

A most beautiful "rig" is described by Mr. Norton, in which the main spar consists of four pieces of bamboo joined at the middle by brass fishing-rod ferrules. Brass tips are used for holding the small ends of the bamboo together at the ends of the main spar. This rig can be taken apart like a jointed fishing-rod, and, like it, put in a comparatively small case, occupying not much more space when the sails are rolled up than an old-fashioned cotton umbrella. Sails may be made of fancy striped cloth and brilliantly colored penants rigged to their corners; combine this with a suitable uniform, and the winged skater will present a most striking and dashing appearance as

he goes flying over the ice.

The Norwegian Rig.

This is a very simple sail to make, as may be seen by referring to Fig. 192. The spars can be made of the same material as the ones described for the Norton rig. The Norwegian rig requires a crew of two, and in this particular differs from all the rest. The man at the bow grasps the main spar with one hand

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just behind the fore cross yard, and with the other hand takes hold of the main spar behind him; the helmsman must stand at

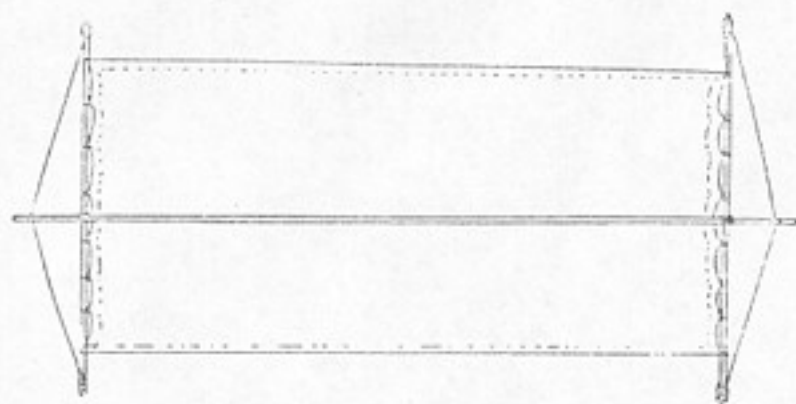


FIG. 192.—Norwegian Rig.

the stern or "aft" end of the sail, so that he can see to steer. The man in front must hold on and trust to Providence and the steersman. This is rather an awkward rig, but it has the advantage of carrying two instead of one, and is consequently in favor with people who like sociability.

The Danish Rig

consists of a mainmast and topmast. The latter can be let down when required. The diagram (Fig. 193) is made of dimensions suitable for a good-sized boy. The straps near the bottom of the topmast are for the purpose of binding the sail to the back of the crew, like a knapsack. The hand-sticks are only attached to the lower corners of the sails, the other ends are held by the crew, crossed

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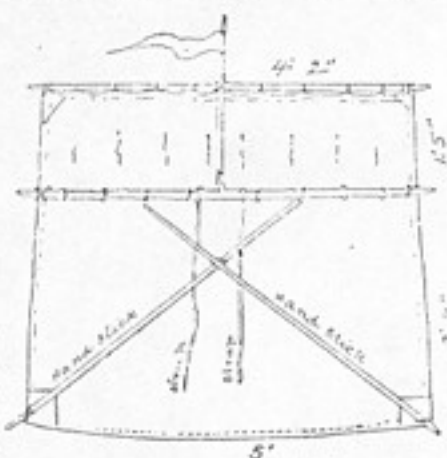


FIG. 193.—Danish Rig.

and used as sheet-lines are in an ordinary sail-boat. The spars may all be made of spruce, pine, cedar, bamboo, or Southern cane, and the sail of heavy cotton sheeting or strong cotton duck, of double thickness at the clews. In experimenting with this rig, it is best to choose a day when there is only a moderate wind, for the sail being bound to your body cannot be cast aside by simply letting go.

The mainsail and topsail are all of one piece of cloth. The topmast is fastened to the middle of the shoulder yard by a leather strap passing around the yard. The topmast is held in place by the wind blowing it against the head of the crew. By running a little into the wind the topsail will fall back and leave only the mainsail up, or if you loosen the cross knot at the upper part of the topmast you can roll the topsail down to the reefing points and lash it there. The steering is done with the feet of the crew. To learn to sail this or any other



FIG. 194.—English Rig.

craft practice is needed. You might as well try to learn to swim from reading a book as to expect to become an expert sailor without going to sea.

The English Rig

consists of a mast and two spars (Fig. 194); the bottom of the mast rests in straps fastened to one leg of the crew, who supports the sail

by placing one arm around the mast, holding on to the top spar with the other hand. This makes quite a pretty craft, though,

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like the Danish rig, the sail must be bound to the crew, which always appears objectionable from the fact that in case of accident there must be more danger of breaking the spars or tearing the sail than there is where the whole thing can be dropped in an instant. The English rig is on something of the same principle as

The Cape Vincent Rig,

which consists of a long spar and a sprit, the spar being in some cases twelve or fifteen feet in length; one seven feet long will make a sail large enough for a boy. The sprit is fastened at the bottom securely to the sail, and fits on to the main spar with a crotch, fork, or jaw. The sail being cut in the right shape

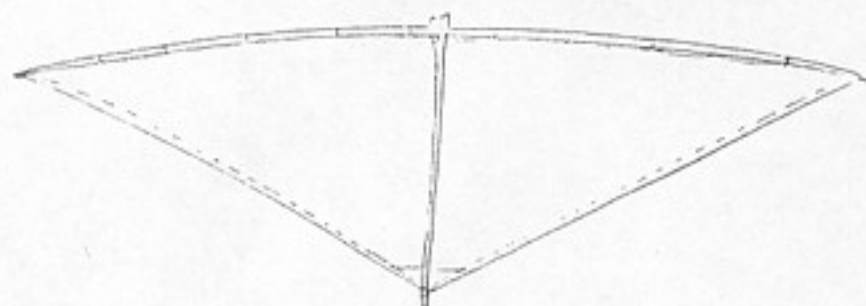


FIG. 195.—Cape Vincent Rig.

and proper proportions, and made fast to the long spar and to the end of the sprit, as soon as the latter is forced into place it will stretch the sail out flat, as in Fig. 195. A boy with one of these rigs on his shoulder makes a very rakish-looking craft. The spar is carried "as a soldier carries his rifle"—on the shoulder; the sprit, or small cross spar, is allowed to rest against the crew's back. According to one writer, who is supposed to have had experience, this rakish craft will not in the least belie its looks. In speaking of it he says: "I should say that on good, smooth ice, with a twenty-five or thirty-

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mile wind, they went at the rate of eighty or one hundred miles an hour." This sounds like an exaggeration, but when we remember that a good ice-yacht, well handled, can make a mile a minute or more, travelling much faster than the wind itself, the statement of the enthusiastic advocate of the Cape Vincent rig does not appear so improbable. In speaking of the speed attained by regular ice-yachts, Mr. Norton says:

"There is no apparent reason why a skate-sailor should not attain a like speed. Other things being equal, he has certain advantages over the ice-yacht. His steering gear is absolutely perfect, assuming, of course, that he is a thoroughly confident skater, and it is in intimate sympathy with the trim of his sail. This nice adjustment between rudder and sails is an important point. Again, there is no rigidity about the rig. Everything sways and gives under changing conditions of wind, and experience soon endows the skater with an instinct which teaches him to trim his sail so as to make every ounce of air-pressure tell to the best advantage."

A Country Rig.

The two forked sticks from which the framework of this sail is made must necessarily be nearly of the same dimensions.

After their ends have been firmly lashed together, as shown by Fig. 196, a sail made of an old piece of carpet, awning, hay-cover, or any cloth that is strong enough or

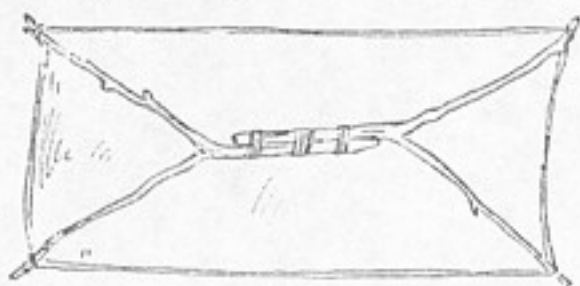


FIG. 196.—Country Rig.

can be made strong enough by doubling, may be lashed on at the four prongs of the forks. This rig will convey a crew of

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two over the ice with as much speed as the more elaborate Norwegian sail (Fig. 192). The country sail may not be handsome, but it possesses the advantage of being easily constructed and costing little or nothing, except the work of cutting and trimming the spars and sail.

CHAPTER XXXI.

WINTER FISHING—SPEARING AND SNARING—FISHERMEN'S MOVABLE SHANTIES, ETC.

The pleasures of fishing are naturally and almost invariably connected in our minds with warm weather, particularly with Spring or the first coming of Summer, the bright freshness of

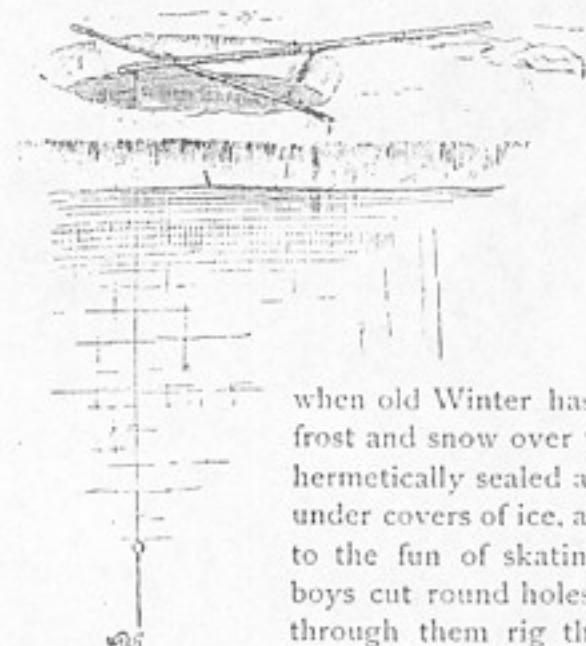


FIG. 197.—Flip-Up Set. A very simple but ingenious contrivance enables a single fisherman to attend to quite a number of lines if the holes be all made within sight of the fisherman.

bursting bud and new-opening wild blossom, and with those latter days in the Autumn over which the Summer King sheds his brightest glories. But in our northern and easterly States,

when old Winter has spread his mantle of frost and snow over the face of Nature, and hermetically sealed all the lakes and ponds under covers of ice, as an agreeable addition to the fun of skating, hardy, red-cheeked boys cut round holes in the thick ice, and through them rig their lines for pickerel-

fishing. A very simple but ingenious contrivance enables a single fisherman to attend to quite a number of lines if the holes be all made within sight of the fisherman.

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the fish itself will give the signal for the particular line that requires attention.

The construction of this automatic fishing-tackle is so simple that it may be made in a few moments by any one. The preceding illustration shows how it is arranged (Fig. 197). At the end of a light rod a foot or two in length is fastened a small signal flag; a piece of any bright-colored cloth answers the purpose. This rod is bound with strong string at right angles to a second stick, which is placed across the hole, lying some inches upon the ice at either side; the flag also rests on the ice, leaving a short piece of the flag-rod projecting over the cross stick; to this short end the line and hook are fastened. The hook is baited with a live minnow or other suitable bait and lowered through the hole. The tackle is then in readiness for the capture of a pickerel. When the fish is hooked his struggles keep the flag flying (Fig. 198).

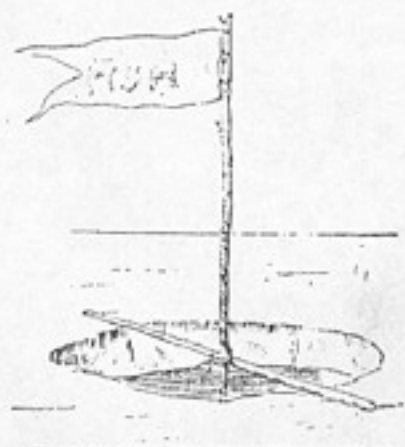


FIG. 198.—The Signal Flying.

Smelt Fishing and the Smelt Fisher's House.

From about December 20th until the middle or latter part of February the smelt fishing season is in its height along the coast of Maine. The fish are caught through holes in the ice. In the vicinity of Belfast clam worms are used for bait; the worms are found in the clam flats.

Notwithstanding the reputation for original inventions possessed by the inhabitants of the Eastern States, the "Down East" smelt fishermen of Maine have for years, while fishing through the ice, exposed themselves to the piercing winter winds,

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apparently without once thinking of providing any other shelter than their heavy overcoats and perhaps a rude barricade of ice blocks and evergreen boughs. There is no telling how long this state of things might have continued, but during the winter of 1877-78 a single fisherman, more enterprising than his comrades, appeared upon the fishing grounds with a small canvas tent, inside of which he at once proceeded to make himself comfortable, and at the same time excite the envy of the unprotected, shivering fishermen scattered over the ice. The latter were not long in taking the hint, and the next season found the ice dotted all over with the little canvas houses of the fishermen. During the best of the season the smelt fishing grounds now have the appearance of Indian villages; the blue smoke curls up from the peaked roofed lodges and floats away on the frosty air, while the figures of men and boys passing to and fro on different errands might at a distance be easily mistaken for the aboriginal red Americans at their winter camp.

The framework of a smelt fisher's house consists of a light wooden frame about six feet square, with a sharp roof. After the frame is firmly fastened together it is put upon runners, furnished with a bench for the fisherman to sit upon, a stove to keep him warm, and a covering of light canvas to keep out the cold. The canvas is a better protection against sleet and frost if it has been covered with a coat of paint. Sometimes the houses are made large enough to accommodate more than one fisherman. Snugly ensconced beside a warm stove, with pipe in

mouth, the old veterans spin their yarns, and, oblivious to the raging northwest winds, watch their lines, which are attached to a rack overhead and hang down, passing through a hole in the ice. The bait dangles about eight or ten feet under the water. When a fish bites, the motion of the line apprizes the fisherman of the fact, and he pulls it out, unhooks the fish and again drops

* According to the Belfast (Me.) Journal.

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his line. In this manner one man will succeed in catching from ten to fifteen pounds in a day.

A gentleman who seems to be posted upon the subject of smelt fishing sends me the following device, which ought to have been included in the chapter on odd modes of fishing.

My correspondent says: "During the fall months the smelt run in large schools up the creeks and streams emptying into the ocean, and are caught with seines or nets by professional fishermen for market. To be

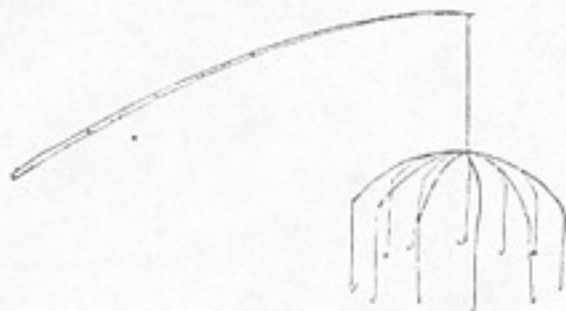


FIG. 199.—The Umbrella Smelt Tackle.

sure, no true sportsman could make use of such means for capturing game; still, as it is necessary to take these small fish in large numbers to make a respectable mess, some ingenious sportsman has evolved a fishing-tackle with which one can legitimately do wholesale fishing. To a line on an ordinary pole is attached an apparatus resembling an umbrella-frame without the handle; from the point of each bow hangs a line and hook (Fig. 199); in this way six or eight smelt may be taken in the time it would require to catch one with a single line."

For boys who live inland where smelt fishing is out of the question, there are other fish whose gamy nature will impart more fun and excitement to their capture. Long rods would be out of place within the narrow limits of a little cloth-covered fishing box; but hand lines or short rod and reel may be used. When a short rod is used it is only for the purpose of facilitating the use of the reel, and the rod should not be over two and one-half feet long. Fish may also be snared or speared through holes in the ice by boys concealed in little

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wooden shanties built for the purpose. This sport is much in vogue on some of the small lakes in the Northwest.

The Spearsman's Shanty.

The great drawback to spearing fish through holes in the ice, is the inability of the spearsman to see objects under water, and to keep the cold winds from chilling him through and through as he stands almost motionless watching for his game;

but if the sportsman will supply himself with one of the little wooden shanties used by the fish spearers in the Northwest, he will overcome both these difficulties. The shanty, when the door is closed, is perfectly dark inside, having no other opening except a round hole, about a foot and a half in diameter, in the floor just over the hole in the ice. The only light seen by the fisherman is the bright, shining water, which glows like a full moon underneath him. As his eyes become accustomed to the peculiar condition of things, the nebulous objects first dis-

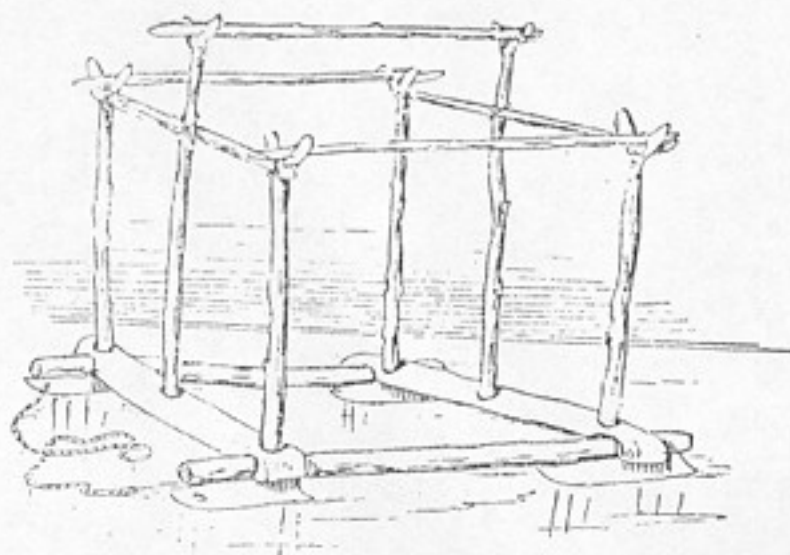


FIG. 200.—Framework for Spearsman's Shanty.

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cernible in the luminous water resolve themselves into floating grasses and reeds; the bottom, even where the water is quite deep, becomes plainly visible, and every passing fish is distinctly seen by the spearsman, while he, being in total darkness, is invisible to the creatures below. This effect can be readily understood when one remembers that the ice, unless it be covered with snow, is transparent, and that the light shining through illuminates the water. It is as if you were standing outside of a house on a very dark night looking through a window into a brilliantly lighted room.

The fishermen's shanties are provided with small sheet-iron stoves, which require but very little fire to make the house warm enough for one to sit with his coat off. The stoves are provided with small pipes, which issue through the roof or side of the house. A bench, camp-stool, or chair complete the furniture.

Snaring Fish.

Catfish may be chummed for; that is, attracted by bait cut up and dropped through the hole in the ice. The bait will attract many other fish, which can be snared with a slip-noose made of fine copper or brass wire and attached to the end of a line. There is nothing alarming in the looks of this instrument, and a fish will not notice the snare until it finds the fatal noose tightly drawn about its body. It requires a little practice to snare fish successfully. I well remember my first attempt. A large "mud sucker" was discovered under an overhanging bank. Cautiously I crept to the edge of the stream, and with trembling, yet careful hand, I let the snare glide gently into the water. The fish did not move; by degrees I slipped the noose over the comical slippery head of the creature, and with a mighty jerk landed—not the fish, but my snare in the boughs of a tree that overhung the water. I was thunder-struck when I discovered that the fine wire of the snare had

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cut the fish completely in halves, and as the muddy water, stirred up by the commotion beneath, rolled away down stream, I beheld one-half of the "mud sucker" with the puckering mouth still moving, and the other half with its tail flapping in the water beneath.

It requires experience to learn just how hard to pull on a snare to catch a fish and hold it without breaking the line or cutting the game.

Spearing Fish

is far more exciting and sportsmanlike than snaring them. The fish may be attracted by dead bait dropped through the hole in the ice, after the manner before described, or if it be pickerel you are after, a trolling spoon can be danced up and down, and round and round, until it attracts the attention of the fish. Some fishermen use a wooden minnow weighted at the bottom with lead and provided with fins and tail made of tin. Such a decoy, to be effective, should be decorated with a brilliant red stripe on each side, a white belly, and a bright green back. By means of a line fastened to the wooden fish it can be made to swim around under water in a most frisky and life-like manner, completely deceiving the unwary pickerel. The decoy must be kept out of reach when the fish dart at it, and at the same time the spear must be poised, ready to cast at the first opportunity. Often the unsuspecting pickerel will stop and remain for some moments motionless directly under the hole in the ice, apparently considering the best mode of capturing the lively and gaudy minnow that dances so temptingly near his hungry jaws. This is a golden opportunity for the young fisherman, and waiting only such time as it may require to take aim, the lance should be launched. A good fish spear is described on page 188 and illustrated by Fig. 121. As soon as a fish is speared it should be thrown upon

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the ice outside the shanty and allowed to freeze. In this manner the meat is kept much sweeter and fresher than it is possible to preserve fish in warm weather, even for so short a time as it requires to carry the game home from the fishing grounds.

How to Build a Fishing House.

Fig. 200 shows the framework for a small fishing house; the posts and cross pieces are made of such sticks as can be found along the bank of any stream or lake. Fig. 201 shows

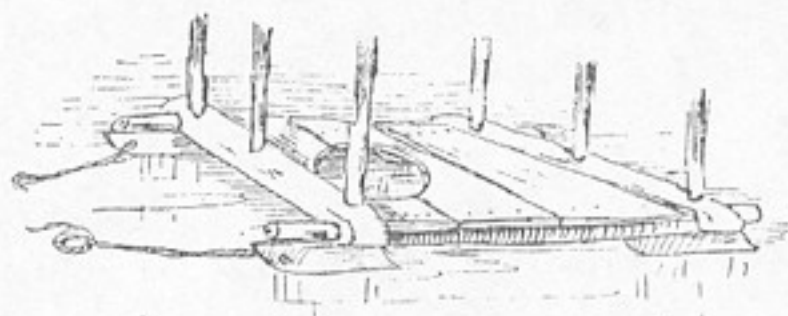


FIG. 201.—Floor and Runners of Spearman's Shanty.

how the floor is made of planks, with a hole in the forward part to fish through. The whole frame may be covered with pieces of an old hay-cover, canvas, or what is better still, pieces of old oil-cloth, such as is used for dining-room or hall floors. If the framework be covered with any light cloth, the cloth should be tacked on and thickly coated with paint so as to admit no light. A frame like the one illustrated by Figs. 200 and 201 may be made, fitted up, and kept stored away until wanted for use. After hauling it out on the fishing grounds and cutting a hole through the ice, the frame can be covered with thick blankets, and without injuring the material the covering can be fastened by pins and strings over the framework and removed when the day's sport is finished. If, instead of rough forked sticks, regu-

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lar square posts be used, the whole can be covered with quarter-inch pine lumber, thus making a light but serviceable shanty. If the light come in under the house, pack snow

around it. If the snow cover the ice to such a thickness as to darken the water beneath, sweep a place clean around your shanty, and the light admitted through the clear ice will illuminate the water beneath your hut or tent. Fig. 202 shows another form of fisherman's hut, made upon the same principle as the cabin of the Crusoe raft (Figs. 70 and 71, pages 99 and 100). Select hickory or any other elastic saplings, taking care to have them all about the same size. After boring holes with an auger in the side bars of the floor frame, bend saplings over and force their ends into the holes as shown in the diagram. The floor can be laid in the same manner as illustrated by Fig. 201, and the whole frame covered with some opaque fabric, or cloth made opaque by a coating of paint. A very beautiful and light fishing house might be made with a bamboo frame that could be taken apart and packed away for the summer like a jointed fishing-rod.

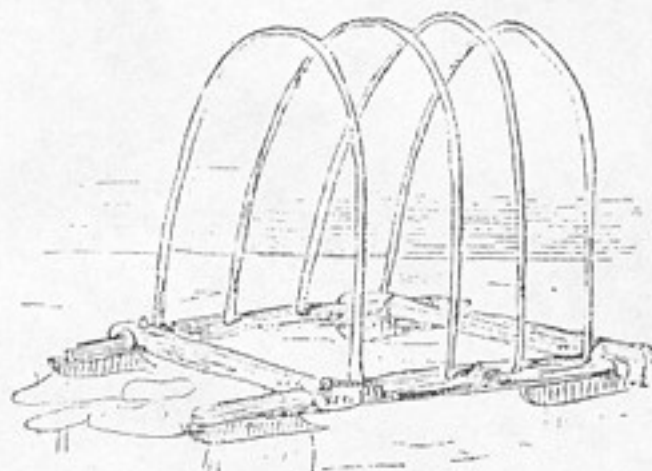


FIG. 202.—Crusoe Cabin Style.

CHAPTER XXXIII.

IN-DOOR AMUSEMENTS.

THERE will frequently occur gaps, in the long winter evenings, that are hard to fill up satisfactorily, hours when, tired of reading or study, a boy does not know what to do. Again, occasionally through the winter one's companions and friends are likely to drop in and spend an evening. The most accomplished host is at times at a loss to know how to entertain his company, after the old, worn, threadbare games have been repeated until they have become monotonous and tiresome.

To the filling of these gaps, and for the relief of the worried host, I propose to devote a limited space and chapter in explaining and suggesting some novelties in the way of in-door amusements.

Bric-à-brac, or the Tourist's Curiosities,

is a comparatively new game, which, in the hands of a smart boy or a fluent speaker, can be rendered entertaining, startling, or boisterously funny. The company, seated at a long table in a very dimly lighted room, must be particularly requested to keep their hands under the table, pay strict attention to the tourist, and maintain a solemn silence. The tourist, from the head of the table, commences his narrative something as follows:

"In the year 1867 I was travelling in Egypt, having been commissioned by a certain scientific association to procure for them as perfect a specimen of a mummy as I could find. I

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made it my particular business to associate as much as possible with the native Arabs, whose ostensible business of guides and donkey masters is but a disguise, and, at the same time, a help to their real trade of grave robbers. Through my interpreter, I let it be known that I was willing to pay a good price for the mummy of some king or noble person—such mummies, being more carefully and skilfully embalmed, are in a much more perfect state of preservation. For some months I was fooled and fretted by these Arab swindlers and cheats, who would take me long distances to show some very common broken specimen. Finally, finding I would not be imposed upon, I received a call one night from a most villainous-looking native, who said for so much money he would introduce me to a certain Amed al Hamu, who could procure me what I wanted. To shorten a long story, I met Amed al Hamu, and after a week's dickering and bargaining made an appointment to meet him alone at his home—one could scarcely say house, for he lived in a sort of tomb cut out of the solid rock some twenty feet up a precipitous rock on the edge of the desert. At the appointed time he met me at the foot of the rock, and after cautiously looking to see if we were watched, led me to his cave. Passing through this, with light in hand we entered a narrow passage cut in the rock; through this we stooped and crawled for about a hundred yards; here the passage ended abruptly, as though unfinished. On one side, near the end, was a large crack or fissure, through which I squeezed myself after my guide, and stood upon the brink of a bottomless pit. From its hiding-place Amed al Hamu produced a rude specimen of rope-ladder, by the means of which we descended some ten feet into the pit; getting off on a ledge of rock I was ushered into a small cavern and found a really valuable mummy in an unusually fine mummy case, after showing which Amed offered to deliver it to me at some *fifty per cent. above* the price originally agreed

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upon. We finally settled the bargain and started to return. As but one at a time could use the rope-ladder, I sent the Arab on first, thinking while he was ascending I might look around, for I felt certain that all those excavations were never made for a single mummy. In the hasty glance I took of the chamber nothing new could be seen, but remembering that the ladder was a very long one, when it came my turn I went down instead of up. Passing a ledge similar to the one just left, I continued down and discovered a narrow landing on the opposite side of the pit. By swinging the rope I reached it and got off. Stepping through a small doorway I stood in a large, spacious chamber; pieces of broken mummy cases and fragments of linen bandages strewed the floor; boxes filled with porcelain statuettes, precious vases of alabaster, jars of bronze and terracotta were piled against the walls. Standing upright and laid at length upon the floor were huge sarcophagi of painted wood. Mummy cases fashioned after the human form crowded the room. Evidently I was amidst the kings and rulers of Pharaonic Egypt. Examining one of the richest sarcophagi I discovered that it had been lately opened, and upon trial lifted the cover off easily; the mummy case inside was broken and half open. There was no doubt, from the fineness of the linen, that the occupant had been royal. It would be hard to say what my emotions were when I opened this mummy case; surprise and astonishment certainly predominated, for there, with bandages and wrappings half torn and cut off, was the

most wonderfully preserved specimen ever seen or heard of. It was, or had been a thousand years ago, a princess of great beauty, and so perfectly was the form preserved that but for the color I should have said she slept!

"It was evident at a glance that the grave-robbing ghouls had here found a prize which they meant to keep a secret until they discovered the most advantageous way of disposing of it.

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Upon closer examination I was shocked to discover that one hand of the beautiful mummy had been severed at the wrist, probably for the purpose of more easily obtaining the bracelet that had once encircled the arm. Pulling aside some of the bundled bandages, I discovered the little delicate, shapely hand. A terrific yell from the Arab above startled me so that I dropped the light, which was instantly extinguished, leaving me in total darkness. Thrusting the mummy hand into an inside pocket I groped my way out to the ledge, shouting help! murder! fire! at the top of my voice; in fact, so loud did I yell that the swarthy son of the desert ceased his shouting, and as he reached the ledge upon which I stood held his light aloft, and discovering me, with no light, standing upon the brink of the dark abyss, his villainous features relaxed into a smile, and, motioning me to proceed, he followed me up the ladder. After I had returned to my stopping-place and taken counsel with some friends, in spite of their advice I dispatched a messenger to Amed al Hamu, proposing to purchase some of the treasures that I knew were hidden in the but half-explored cave. The only answer I received was a message from the sheik, or chief of the village, stating that I had in some way 'incurred the ill will and animosity of the populace,' and had better therefore absent myself immediately, as he, the sheik, 'was powerless to protect.' It is hardly necessary for me to state that I acted upon this hint and left; I am free to acknowledge that I think more of my own body than any mummy that was ever embalmed. The beautifully shaped hand I still have as evidence of my adventure, and if you will kindly pass it to one another under the table each may feel its peculiar texture."

The tourist then takes from a basket at his side a kid glove, previously prepared by stuffing it with damp sand and allowing it to rest on ice for an hour or so. The guests should be repeatedly cautioned about dropping the specimen, otherwise the

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peculiar cold, damp feeling of what seems to be the hand of a mummy will cause the nervous ones to throw it from them in a hurry. After this has made the circuit of the table, the tourist places it upon a waiter in front of him and proceeds to explain the capture of a very curious sea-urchin, which turns out to be a pincushion with the points of pins sticking out all over it. Next comes a piece of the Japanese weeping crystal from a cave in the centre of Simoda—simply a piece of ice; and so the game continues with as many queer specimens as the ingenuity of the tourist can invent. A glib talker can so excite the imagination of his hearers as to often make them believe for the time that the object they are handling under the table is genuine. When, after the game is over, the contents of the tourist's basket are exposed for the audience to examine by sight as well as touch, there is always a great laugh as each one recognizes some familiar object, which, with the help of a dark room and a vivid imagination, sent the chills down his back.

Mind-Reading.

This is more in the nature of a trick than a game, but as anything that creates surprise or approaches the wonderful always proves attractive and entertaining, I introduce this plan of reading the contents of a folded paper by laying it across the forehead. The mind-reader seats himself at a table at one end of the room; the audience must not approach nearer than five feet, and should be seated in a semicircle in front of him. Slips of paper, all the same size and shape, are then distributed among the audience, with the request that each one write thereon a short sentence, plainly and in English. While they are busy writing, the mind-reader, or medium, is preparing for the trial by first making sundry passes across his forehead, rubbing each arm slowly from shoulder to wrist, and then sitting calm and silent, staring at the wall. Each person folds his

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piece of paper carefully, and they are all collected by some one, who, standing alongside the medium, presses the first paper folded on the medium's forehead, who with closed eyes immediately reads the contents out loud, and then verifies it by taking, opening, and re-reading it with his eyes open, and requests the writer to acknowledge it, after which the second paper is treated in a similar manner, thus continuing until every paper has been read and acknowledged. All this appears very wonderful and inexplicable to the uninitiated, but perfectly simple when explained. The party who collects the papers is the medium's confederate, and should be selected from among the guests some time before the game is proposed, and in another room be thoroughly drilled so as to make no mistakes. The confederate's part is very easy. It is simply to let the medium know what is to be written on his piece of paper, and be careful to leave that particular message for the last one to be read. On these two points depend the success of the experiment, for it makes no difference what the first message is. The medium reads out whatever the confederate was to write, and while pretending to verify it by re-reading with his eyes open, he really is fixing in his memory the lines in the first paper, which he reads out as the contents of the second message. The second is read as the third, and so on through them all. The confederate's message, which was read out as coming first, being the last, brings them out even.

A Literary Sketch Club

is a new idea, which has been tried and has proved very successful, the original club having prospered through three winters, and still boasts of some thirty enthusiastic members. The idea of the club is that each member illustrate the same subject (previously selected) in any way he thinks fit—the artists, if there be any present, by a drawing or painting on the subject;

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a member who sings may select, adapt, or originate a song that will express his idea of the subject. Instrumental music may be made to tell the story; short sketches, in prose or poetry, original essays, or selections carefully made from good authors; in fact, there is scarcely any one who cannot illustrate the subject in some way that will add to the entertainment of the evening. I annex the Constitution of the original club, which I know from practical experience works well:

CONSTITUTION.

I. NAME.

The name of this society shall be the — LITERARY SKETCH CLUB.

II. OFFICERS.

The officers of this club shall consist of a president, a secretary, an editor, and an associate editor.

The duties of president and secretary shall be such as usually pertain to such offices.

The editor shall have entire control of a paper to be issued by the club.

The duties of the associate editor shall be to assist the editor in the work of publishing the paper, and to take control of the paper in case of the illness or absence of the editor.

The election of officers shall take place at the first meeting held each season, their term of office to expire upon the next election day.

III. MEETINGS.

The regular meetings of the — Literary Sketch Club shall be held once in every two weeks.

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IV. SUBJECTS FOR ILLUSTRATION.

The subject to be illustrated must be selected by the member who is to next entertain the club, and announced by him at the meeting preceding the one to be held at his house.

V. SKETCHES.

A sketch illustrating the subject selected will be expected from each member present.

The said sketches may be essays, poems, songs, music, pictures, or any other method of illustration that may suggest itself. Original sketches are not absolutely required.

Contributions for the club paper must be sent to the editor; they may be anonymous.

VI. ELECTION OF NEW MEMBERS.

Candidates for membership may be proposed at any meeting and the election proceeded with, two black balls excluding the candidate from membership.

VII. ABSENCE.

Absence from three consecutive regular meetings, without an acceptable excuse, will be considered equivalent to a resignation, and the absentee's name may be acted on accordingly.

VIII. ORDER OF BUSINESS.

1. Roll call.
2. Reading of the minutes of the previous meeting
3. Presentation of sketches.
4. Reading of the club paper.
5. Reports of committees.
6. Miscellaneous business.
7. Proposals and election of members.
8. Adjournment.

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IX. AMENDMENTS TO CONSTITUTION.

This Constitution can be amended only at a regular meeting by a two-thirds vote, due notice of intended amendment having been given at the previous regular meeting.

PRINTING PRESSES.

Little printing presses may be had at such reasonable prices

that some member might have one; in that case the club paper, printed in due form, would prove a souvenir which would be prized and carefully kept by each member, especially should it contain an article by himself. In the original club the paper was carefully and neatly written in a blank-book, and in some instances illustrated by an artistic member.

CHAPTER XXXIV.

THE BOY'S OWN PHUNNYGRAPH.

TO BE EXHIBITED

By Prof. Edd and Son.

IN winter-time, when a great part of a boy's fun must be found in-doors, it is a good thing to know how to get up amateur exhibitions of various kinds. In this way boys can have a good time while preparing the shows, and may also afford a great deal of pleasure to their companions and friends who make up the audiences.

One of the most entertaining parlor exhibitions which can be given at a moderate expense by a party of bright boys, accustomed to the use of carpenters' tools, is "The Boy's Own Phunnygraph," invented by the author, who once exhibited one at an amateur performance before an audience of five hundred people.

The first thing necessary in the construction of this very peculiar machine is a dry-goods box, large enough for a boy to sit inside of it without discomfort. The top must be firmly nailed on and the two sides taken off, thus leaving nothing but the top, bottom, and two ends of the box. The sides, each of which probably consists of two or three pieces of board, are to serve as doors, and therefore must be firmly fastened together by means of cleats or narrow strips of board nailed across them. One side of the box, which we shall call side A, must be

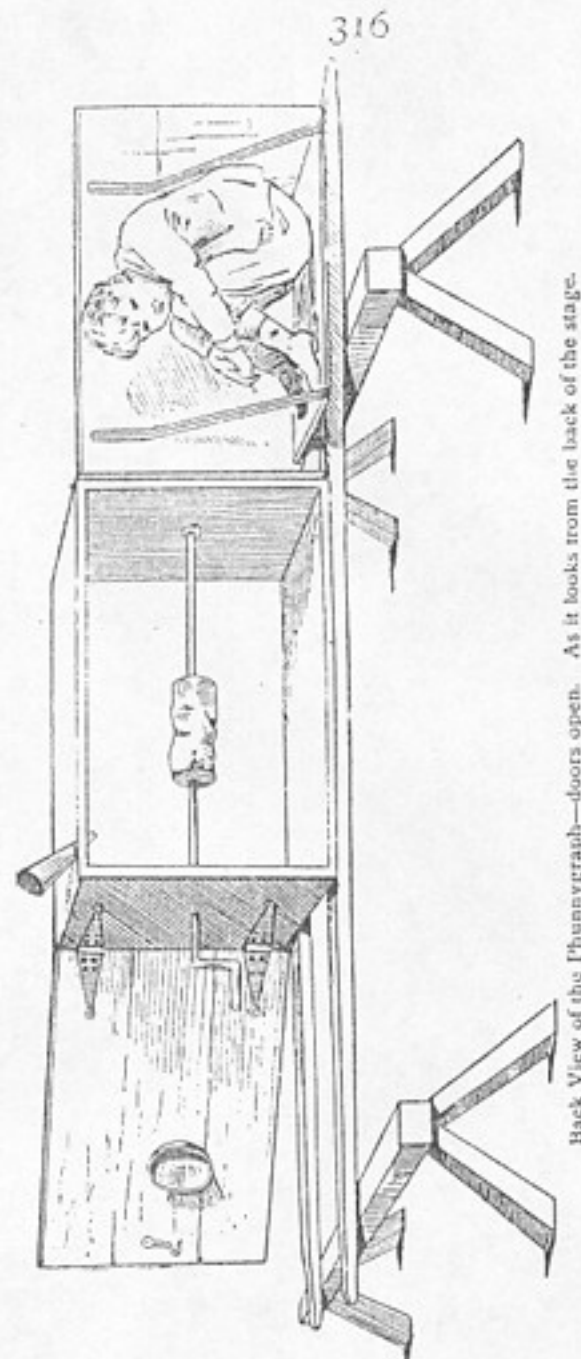
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very strong, and will probably require three cleats. The other side, B, which is in front when the apparatus is in use, must now be fastened to the box by a pair of hinges strong enough to sustain its weight. There should be a hook on it, to keep it shut when necessary.

A shelf wide enough for a small-sized boy to sit upon must be attached to side A, and should be supported by iron braces. Strong leather straps will do if a blacksmith is not handy, but they must be very firmly fastened to the shelf and to the back door of the box, as we shall now call side A. As a small boy with a strong voice is to sit on this shelf, it would ruin the exhibition if the shelf were to break down, not to speak of the damage which might be done to the boy. Hence this back door must be fastened to the box by heavy gate or barn-door hinges.

Two strong wooden bars or handles must now be secured to the bottom of the box, and should project far enough at the ends of the box to allow a boy to stand between them, at each end, when the box is to be lifted or carried.

The rest of the necessary work is very easy. A crank, or turning handle (which will turn nothing), is to be fastened to one end of the box; and two holes—about two inches in diameter—are to be made, one in the front door and one in the top of the box. In each of these a tin or pasteboard horn is to be fastened—the one on top to be smaller than the other.



Then on the inside of the box a round stick—a broom-stick will answer—is to be placed on two notched blocks fastened to the ends of the box, so that it can be easily taken out of its place by the small boy, and put back again, when occasion requires. A tomato-can may be stuck on the broom-handle, so that it will look like a tin cylinder containing something or other of importance. This round stick, with its cylinder, is only for show, but it should not be omitted.

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Nothing more is now necessary but a pair of wooden trestles, or horses, such as carpenters use, on which the box is to stand during the exhibition.

Having explained how to make this novel phonograph, I have only to tell you how it is to be used. It is evident, from what I have said, that there is to be a small boy in that box, and the fact is that he is the most important part of the whole machine; for this is only a piece of fun, intended to excite curiosity and amusement in the audience, who may, perhaps, imagine that there is a small boy somewhere about the apparatus, but who cannot see where he is.

The phunnygraph, which should stand in a room opening into that in which the audience is to assemble, or it may be behind a curtain, must be arranged in working order some minutes before the time fixed for the exhibition to commence.

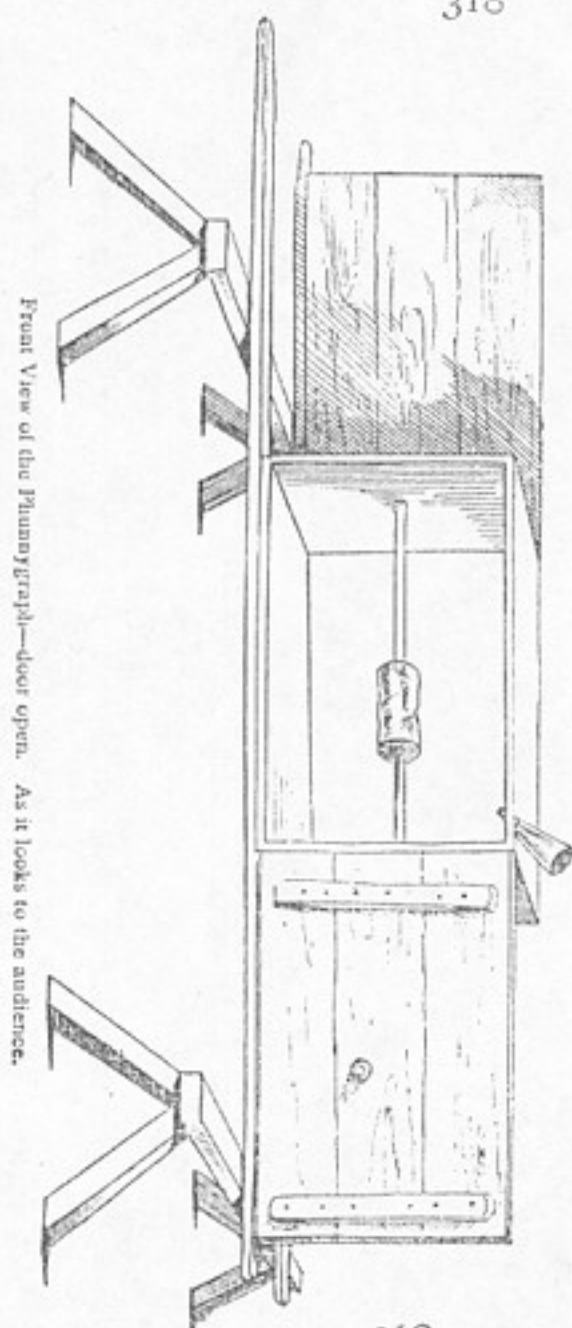
The way to arrange it is as follows: The back door of the

box must be opened and the small boy seated on the shelf. The door is closed, the boy going into the box as it shuts. The front door is also shut. If the broom-handle and tomato-can are in the boy's way, he can take them down and put them on one side.

The Professor—who is to exhibit the workings of the machine, and who should be a boy able to speak fluently and freely before an audience—must now come out and announce that the exhibition is about to begin. He should see that the wooden horses are so placed that the box will rest properly upon them, and should make all the little preparations which may be necessary. Then, after a few words of introduction, he may call for his phunnygraph, and the box will be borne in by two boys.

After the bearers have walked around the stage, so that both sides of the box may be seen by the audience, it must be

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placed on its trestles, or stands, with the front door toward the company.

The Professor will then call attention to the fact that the persons present have seen each side of the box, and can see under and all around it, thus assuring themselves that it has no connection with anything outside of it, except the stands on which it rests. He will then proceed to open it, taking care to open the back door first. The small boy swings back with

the door, which conceals him from the audience as it stands open. As soon as the Professor announces that he is about to open the box, the small boy must put the broom-stick in its place if he has taken it down. Then the Professor throws open the front door and shows that there is nothing in the box but the rod and cylinder, which seem to be attached to the crank. What machinery may be concealed in that little tin cylinder, he does not feel called upon to say.

After a few minutes for a general observation of the inside of the box, he closes it, being very careful to shut the front door first. Then the small boy takes down the broom-stick, puts it out of his way, and proceeds to make himself comfortable and ready for business.

The Professor now begins to exhibit the phunnygraph by speaking into the horn at the top of the box. He generally commences with a short sentence, pronouncing each word loudly and clearly, so that every one can hear it. He gives the crank a few turns and calls upon the audience to be very quiet and listen, and then, in a very few moments, the same words that he used are repeated from the horn in the front of the box, the small boy within imitating, as nearly as possible, the voice and tone of the Professor.

The exhibition may go on as long as the audience continues to be interested and amused. All sorts of things may be spoken into the box, which, after a few turns of the crank, will be re-

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peated from the mouth-piece or horn in the front door. Various sounds may be reproduced by means of this machine, and an ingenious Professor and a smart small boy can make a deal of fun.

A startling final effect may be produced if, after the Professor has crowed into the upper horn, the boy inside can manage, unperceived—say by means of a small sliding-panel—to throw out a live, strong-voiced rooster.

But it must not be supposed that an exhibition of this kind will be successful without a good deal of careful preparation and several rehearsals. Every one should be perfectly familiar with his duty before a performance in front of an audience is attempted. The box-doors should work perfectly, the small boy should be able to sit on his shelf in such a way that his head will never stick up when the back door is open, and he should practice putting up the broom-stick when the Professor announces that the box is to be opened. By the way, if the box is opened several times during the performance to oil the rod, or to do some little thing to the cylinder, it will help to excite the curiosity of some of the audience; but the Professor must not forget that the front door must never be open when the back door is shut. The boys who carry the box should also carefully practice their business, so as to set the box down properly on its supports, and to see that it is firmly placed. It may be necessary for one or both of them to sit on the front handles when the back door, with the boy on it, is swung back, so as to balance his weight and prevent an upset. But experiment will show whether this is necessary or not.

As to the business of the Professor and the small boy, that, of course, must be carefully studied. It will not do to rely on inspiration for the funny things which must be said by the Professor, and imitated by the boy in the box. The Professor may bark like a dog, crow like a cock, or make any curious

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sound he pleases, provided he knows, from practise at rehearsal, that the small boy can imitate him.

The cost of the box, hinges, braces, etc., will probably be between two and three dollars. If the box is painted, or covered with cheap muslin, it will look much more mysterious and scientific.

CHAPTER XXXV.

HOW TO MAKE PUPPETS AND A PUPPET-SHOW.

THE puppet-show is certainly an old institution; and, for aught I know, the shadow-pantomime may be equally ancient. But the puppet-show here described originated, so far as I am aware, within our family circle, having gradually evolved itself from a simple sheet of paper hung on the back of a chair, with a light placed on the seat of the chair behind the paper.

The puppets (not the most graceful and artistic) originally were impaled upon broom-straws, and by this means their shadows were made to jump and dance around in the most lively manner, to the intense delight of a juvenile audience. As these juveniles advanced in years and knowledge, they developed a certain facility with pencil and scissors; the rudimentary paper animals and fairies gradually assumed more possible forms; the chair-back was replaced by a wooden soap or candle-box with the bottom knocked out; and the sheet of paper gave way to a piece of white muslin. Thus, step by step, grew up the puppet-show, from which so much pleasure and amusement have been derived by the writer and his young friends that he now considers it not only a pleasure, but his duty, to tell his readers how to make one like it for themselves.

The construction of properties and actors, and the manipulation of the puppets at an exhibition, are by no means the least of the fun. To start the readers fairly in their career of stage-managers, this chapter tells how to build the theatre.

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make the actors, and the next chapter gives an original adaptation of an old story, prepared especially for a puppet-show.

How to Make the Stage.

Among the rubbish of the lumber-room, or attic, you can hardly fail to find an old frame of some kind—one formerly used for a picture or old-fashioned mirror would be just the thing. Should your attic contain no frames, very little skill with carpenters' tools is required to manufacture a strong wooden stretcher. It need not be ornamental, but should be neat and tidy in appearance, and about two feet long by eighteen inches high.

On the back of this tack a piece of white muslin, being careful to have it stretched perfectly tight, like a drum-head. The cloth should have no seams nor holes in it to mar the plain surface.

A simple way to support the frame in an upright position is to make a pair of "shoes," of triangular pieces of wood. In the top of each shoe a rectangular notch should be cut, deep enough to hold the frame firmly. Fig. 203 shows a wooden frame, and the manner in which the shoes should be made.

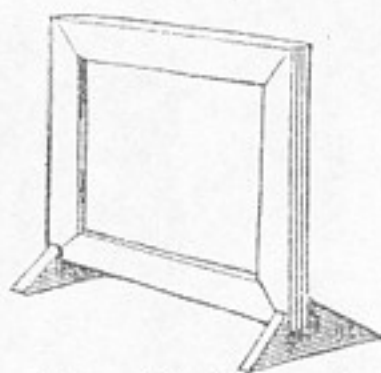


FIG. 203.—Wooden Frame for Puppet-Show.

The Scenery

can be cut out of card-board. Very natural-looking trees may be made of sticks with bunches of pressed moss pasted upon the ends. Pressed maiden-hair fern makes splendid tropical foliage, and tissue or any other thin paper may be used for still water. Thin paper allows the light to pass partially

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through, and the shadow that the spectator sees is lighter than the silhouette scenery around, and hence has a sort of translucent, watery look. Scenery of all kinds should be placed flat against the cloth when in use.

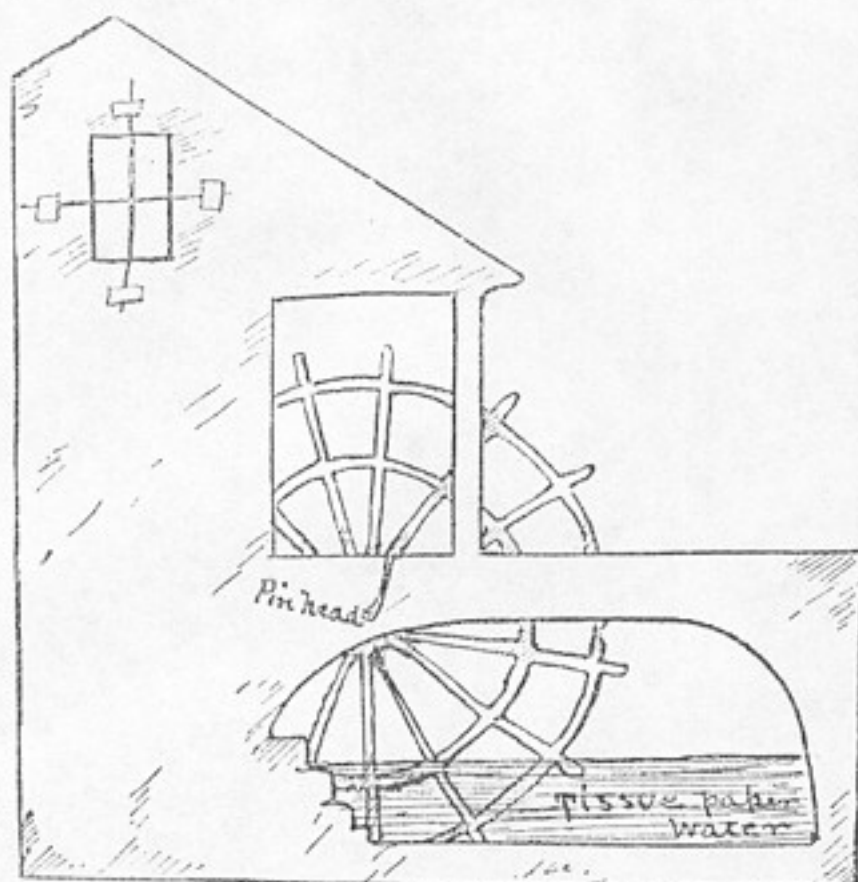


FIG. 204.—Diagram of the Old Mill.

And now that you have a general idea how the show is worked, I will confine my remarks for the present to the play in hand. It is a version of the old story of "Puss-in-Boots," and there will be given here patterns for all the puppets neces-

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sary, although in the court scene you can introduce as many more as you like.

The first scene is

THE OLD MILL.

This scene should be made of such a length that, with the bridge, it will just fit in the frame. Take the measurement of the inside of the frame. Then take a stiff piece of card-board of the requisite length, and with a pencil carefully copy the illustration (Fig. 204), omitting the wheel. Lay the card-board flat upon a pine board or old kitchen table, and with a sharp knife (the file-blade is the best) follow the lines you have drawn. Cut out the spaces where the water is marked, and paste tissue-paper in their place. Take another piece of card-board and cut

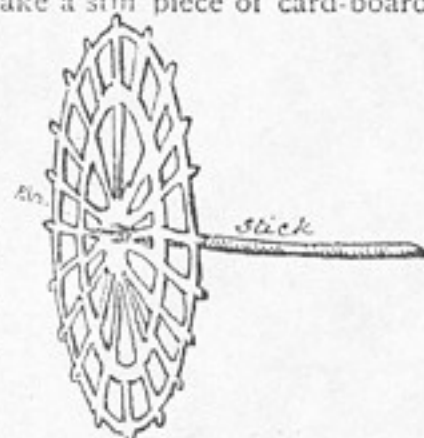


FIG. 205.—The Mill Wheel with handle attached.

out a wheel; in the centre of this cut a small square hole, through which push the end of a stick, as in Fig. 205. Drive a pin into the end of the stick, allowing it to protrude far enough to fit easily into a slot cut for that purpose in the bridge where it comes under the mill (see Fig. 204). The wheel can then be made to turn at pleasure by twirling between the fingers the stick to which the wheel is attached.

PUSS.

To make puss, take a piece of tracing-paper and carefully trace with a soft pencil the outlines of the cat, from the illustration here given. Tack the four corners of the tracing re-

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versed (that is, with the tracing under) on a piece of card-board. Any business card will answer for this purpose. Now, by going over the lines (which will show through the tracing-paper) with a hard pencil, you will find it will leave a sufficiently strong impression on the card to guide you in cutting out the puppet.



Live Rabbit.

Dead Rabbit.

Almost all puppets can be made in the same way. Puss as he first appears, the rabbit, rat, and bag, should be impaled upon the end of a broom-staw; but the remaining puppets should each have a stick or straw attached to one leg, or some other suitable place, just as the stick is pasted to the donkey's leg as represented in Fig. 206.

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CORSANDO AND THE DONKEY

are made of two separate pieces, as indicated in Fig. 206. The dotted line shows the continuation of the outline of the forward piece. Cut out the two pieces in accordance with the diagram, and then place the tail-piece over the head-piece, and at the point marked "knot,"

make a pin-hole through both pieces of the puppet. Tie one end of a piece of heavy thread into a good hard knot; put the other end of the thread through the holes just made, draw the knotted end close up against the puppet, and then

tie another knot upon the opposite side, snug against the card-board; cut off the remaining end of the thread. Having done this, tie a piece of fine thread to the point near the knee of Corsando, and fasten a stick to the foreleg of the donkey, as shown in Fig. 206. Paste a straw in one of Corsando's hands for a whip, and two pieces of string in the other hand for a halter or

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bridle. By holding in one hand the stick attached to the leg of the donkey, and gently pulling the thread, marked "string" in the diagram, the donkey can be made to kick up in a most natural and mirth-provoking manner.

THE ROYAL COACH.

When you make the king and princess in their coach, by

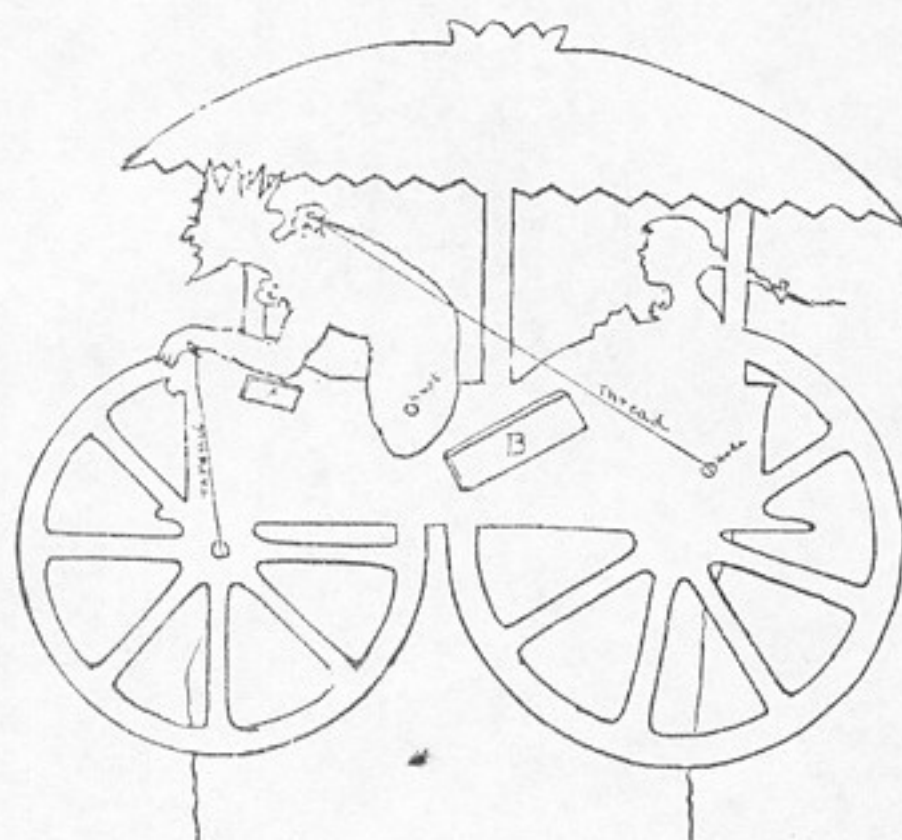


FIG. 207.—King and Princess in the Royal Coach.



FIG. 206.—Corsando on his Donkey.

cutting out the king separately and fastening the lower end of his body to the coach in the manner described for joining the
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two parts of the donkey, the king can in this manner be made to sit upright, or to fall forward and look out in the attitude shown by Fig. 207, which explains the construction perfectly, A and B being two small blocks pasted on to the card-board



FIG. 208.—Leader, or First Horse, of Royal Coach.

for the king's arm or body to rest on. Fig. 208 shows the first horse of the royal coach; the second horse is a duplicate of the first, minus the rider. Fasten the horses and coach together by pasting a long flat stick extending across from horse to horse, and to the coach, where the traces would be.

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CARABAS.

Fig. 209 shows Carabas in a *bathing suit*.

Fig. 210 shows the same gentleman in court dress.



FIG. 209.—Carabas in *Bathing Suit*. FIG. 210.—Carabas in Court Dress.

How to Work the Puppets.

To make puss carry the bag, the operator will have to use

both hands, holding in one hand the stick attached to puss, and in the other the straw attached to the bag. Then, by keeping the bag close against puss's paws, it will appear to the audience as if he were holding the bag. In the same manner he is made to carry the dead rabbit to the king. When the rabbit seems to hop into the bag, he in reality hops behind it, and then drops below the stage.

The operator must remember never to allow his hands
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to pass between the light and the cloth, as the shadow of an immense hand upon the cloth would ruin the whole effect. All the puppets for each scene should be carefully selected before the curtain rises, and so placed that the operator can at once lay his hand upon the one wanted. There must be no talking behind the scenes, and the puppets should be kept moving in as life-like a manner as possible while their speeches are being read for them. Several rehearsals are necessary to make the show pass off successfully.

Stage Effects.

One would naturally suppose that with only a candle and a cloth screen for a stage, and some puppets cut out of card or pasteboard for actors, that the stage effects would be very limited, and consequently the plays stiff and uninteresting; this is, however, not true; any of the familiar old fairy tales may, with a little alteration, be arranged for a puppet-show and put upon the stage in such a manner as to amuse and interest an audience of young and old people. Jointed puppets, by the aid of movable lights, sticks, and strings, may be made to go through the most surprising contortions and manoeuvres.

Boys that have a talent for drawing will find an unlimited amount of amusement in drawing and cutting out the puppets; but for those boys who have neither a talent nor a taste for the use of the pencil, original puppets are necessarily out of the question. All the characters of any play can be made by selecting appropriate figures of animals and men from illustrated books and papers, and enlarging or reducing them after the manner described in Chapter XXVI., page 250. In this manner the puppets given in this chapter may be enlarged to almost any required proportions.

At a Sunday-school entertainment, given in Brooklyn last winter, the following play of "Puss-in-Boots" was produced by

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pasteboard actors a foot high, to the great delight of a large and enthusiastic audience of mixed young and old folks.

How to Make a Magical Dance.

Have one or two jointed figures appear and commence to dance, and while they are capering around, let another light be brought in; immediately there will be two figures for every one that first appeared upon the scene. Each light casts a shadow, and the shadows are all that is visible to the audience, so to them the puppets appear to fall into doubles in the most unaccountable manner. If the puppets are kept stationary, and the two lights moved backward and forward, the puppets will appear to move around, pass and repass each other; thus, with two or three lights moving behind the screen, two or three puppets can be transformed into a crowd that will be in constant motion.

How to Make a Sea Scene.

Cut two duplicate pieces of pasteboard in the form of waves (see Fig. 211). Let each piece be a little longer than the



FIG. 211.—Pasteboard Waves.

frame of the puppet-show stage. When the light throws the shadow of one of these pieces of pasteboard upon the muslin screen, it looks like a simple row of scallops; but when the two pieces are moved backward and forward, it gives motion to the shadows, and they have the appearance of rolling waves; a pasteboard ship rocking upon the waves will add to the effect. A lighthouse can be cut out of pasteboard and placed upon a pasteboard rock at one side; thunder may be imitated by roll-

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ing croquet balls over the top of a wooden table, and lightning represented by small flashes of gunpowder.

If the puppet ship be held at first some distance from the screen the shadow will be large, and if the puppet slowly approach the screen it will decrease in size and have the appearance of gradually sailing away. In this manner the hero and heroine may be made to escape aboard a vessel from the irate and stern parents. Many other scenes can be produced with very simple means that will suggest themselves to the young showmen after a few experiments with the puppet-show. Colored lights used very sparingly often come in with telling effect. A phantom ship can be made to follow the real one by having another light some distance off; one light will cast a heavy shadow and the other a faint one, which will move as the light moves; move the light up and down, and the ship and waves follow and keep time with the light. Many other effects I used to produce in my puppet-shows that at present escape my memory, but no doubt the reader will think of them himself if he becomes interested enough to make a puppet-show for the entertainment of himself and friends, Christmas or New Year's eve; in which case Old St. Nicholas, with his sleigh drawn by deer and loaded with toys, must form part of the show.



Miller.

Carabas (not yet a Marquis).

CHAPTER XXXVI.

PUSS-IN-BOOTS.

Dramatized and Adapted for a Puppet-Show.

PUSS-IN-BOOTS.

PUPPETS: CARABAS, afterward the MARQUIS; his oldest brother, the MILLER; CORSANDO, his next older brother; PUSS-IN-BOOTS; WOLFGANG, the Ogre; KING; PRINCESS; KING'S SERVANTS; DONKEY; RABBIT; BAG; RAT. Also, if desired, COURTIER.

Act I. Scene I.

SCENE: Landscape with tree, bridge, and mill at one side. CORSANDO discovered riding the DONKEY backward and forward over the bridge. MILLER and CARABAS emerge from the mill and stop under tree.

MILLER: Come, come, brother Carabas, don't be downcast!
You know, as the youngest, you must be the last.

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Our father, of course, left to me the old mill,
And the ass to Corsando, for so reads the will;
And he had nothing else but our big pussy-cat,
Which is all he could give you. A fool can see that!
Yet Dick Whittington once the Lord Mayor became,
And his start and yours are precisely the same.
But see! I am wasting my time from the mill,
For while I am talking the wheels are all still.
I have nothing to give you—be that understood.
So farewell, my brother! May your fortune be good.

[Exit MILLER into mill, when wheel begins to turn. CORSANDO approaches, and stopping the DONKEY in front of CARABAS, addresses him.]

CORSANDO: Now, dear brother Carabas, take my advice:
Go hire out your cat to catch other men's mice.

[CORSANDO turns to leave; PUSS comes out and gives the DONKEY a scratch, causing him to kick wildly as he goes off.]

CARABAS: O Fortune, befriend me! what now shall I do?
Come, Pussy, stay by me—I depend upon you.
You are all that I have, but can do me no good,
Unless I should kill you and cook you for food.

PUSS: Meow! Meow! Kill me not, my good master, I pray—
Have mercy upon me! Now list what I say:

I'm no common cat,
I assure you of that!

In the top of the mill, where the solemn owl hoots,
You will find, if you look, an old pair of top-boots.
Bring them to me,
With the bag you will see
Under the mill, by the roots of yon tree.

CARABAS: Well, Puss, what you ask for I will not refuse,
Since I have all to gain and have nothing to lose.

[Exit into the mill.

[PUSS stands a moment as if to think, then capers up and down the stage and speaks.]

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PUSS: A rat? Bah! what's that?
Sir Whittington's cat
Would have grown very fat
Had she lived upon such prey
All the time, day after day,
Till she made a Lord Mayor of her master!
But mine shall gain a name
Through much sweeter game,
And not only climb higher but faster!

[Exit.

[Shift the scene by removing the light and, while the stage is dark, removing the mill and in its place setting up some trees.]

Act I. Scene II.

SCENE: Woods. Enter PUSS-IN-BOOTS, carrying BAG.

PUSS: Mey-o-w! m-e-y-o-w!

Were it not for these boots I should sure have pegged out;
 But if I'm not mistaken, there's game hereabout,
 For I scent in the air
 A squirrel or hare.
 I wonder now whether he's lean, lank, or stout?
 But I know a habit
 Of the shy little rabbit:

He'll enter this bag, and then, my! won't I grab it?

[Arranges BAG and hides; RABBIT comes out, and after running away several times, enters the BAG, when PUSS pounces upon it.]

PUSS: To the King in a moment I'll take you, my dear,
 For he's e'en over-fond of fat rabbits, I hear.

An' I once gain his ear

I see my way clear;

For I'll tell him a story both wondrous and queer.
 And then my poor master'll have nothing to fear—
 If he acts as I bid him, good fortune is near!

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[Curtain.]

[Aside.]

(Cats must have a conscience callous
 Who work their way into a palace!)

Now, if it please your Majesty,

I will return, and eagerly

To my marquis-master bring

This kind message from his King.

[Exit, bowing. Curtain.]

Act II. Scene II.

SCENE: High-road; one or two trees. CARABAS and PUSS-IN-BOOTS discovered.

PUSS: Meow! my good master, have patience, I pray.

CARABAS: Patience to doctors! I'm hungry, I say!

PUSS: All will go well if you mind me to-day,
 And while the sun shines we must surely make hay.

CARABAS: Carry your hay to Jericho!
 Who can eat hay, I'd like to know!

PUSS: Meow! my good master, your help I implore,
 And while I help fortune, you open the door.

CARABAS: No house do I own, so where is the door?—

Ah! Pussy, forgive me, I'll grumble no more,

But help all I can in your nice little plan;
 For I know you have brains, Puss, as well as a man.

PUSS: Meow! my good master, e'en though you froze,
 You must bathe in yon river!

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[Exit CARABAS.]

Act II. Scene I.

SCENE: King's Palace. KING discovered standing behind a throne. PRINCESS and attendants standing around. A loud "meow!" heard without. KING and COURT start. Enter PUSS, with RABBIT in his paws.

PUSS: Meow! My great liege, may your Majesty please

To smile on a slave who thus here, on his knees,

A humble offering
 From Carabas doth bring.

And, Sire, my master further bade me say,
 If it please his gracious King, he will gladly
 send each day

The choicest game that in his coverts he can find;

And your kind acceptance of it still closelier
 will bind

A hand and a heart as loyal and true

As e'er swore allegiance, O King, unto you!

KING: Your master has a happy way
 Of sending gifts. Thus to him say,
 That we accept his offer kind,
 And some good day, perhaps, may find
 A way to thank him which will prove
 We value most our subjects' love.

Carabas, is your master's name?

What rank or title doth he claim?

Shall we among the high or low

Look for your lord, who loves us so?

PUSS: A marquis is my master, Sire;

In wealth and honor none are higher.

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And now for his clothes!

The King's coach is coming, and I've laid a scheme—
 Though of that, I am sure, the King doesn't dream.

The coach is in sight! Now, may I be blessed
 If I don't wish my master was wholly undressed!

[Loud cries without.]

There! now hear him screaming—the water is cold;
 I'll go bury his clothes, for they need it! they're old.

[Exit PUSS, who soon returns. As he re-enters, the KING's coach appears.]

PUSS: Meow! my good master! Alas for him!

Help! fire! murder! My master can't swim.

[Runs to coach.]



Servant with boat-hook. "Ho, slaves! to the rescue!"

Help! help! gracious King, or Lord Carabas drowns!

KING: Ho, slaves! To the rescue! A hundred gold crowns

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Will we give to the man who saves Carabas' life!



The King: "Your master has a happy way of sending gifts."

[SERVANTS rush across the stage. KING continues, aside:]

My daughter shall soon make the marquis a wife.
PUSS (aside): Mighty keen are a cat's ears!
Who knows all that Pussy hears!
This is better than I hoped for, by a heap.
What a very lucky thing
The blessed, kind old King
Doesn't know this shallow river isn't deep!

[Exit PUSS, running after SERVANTS. PUSS immediately returns, crying:]

O King! what a combobbery!
There's been an awful robbery.
And no clothing for the marquis can we find.
KING: That is no great disaster,
For tell your worthy master
We always pack an extra suit behind.
If we can trust our eyes,
He's just about our size.
So, while in yonder grove we take a rest,
Your master'll not encroach;
Tell him to use our coach,
And not to haste, but drive up when he's dressed.

[Exit coach, backing out, the DRIVER crying:]

Whoa! Back! Back! No room to turn here!
Whoa! Back! Back!

[Enter CARABAS, in bathing suit. PUSS runs after him.]

PUSS: Meow! my good master!
I couldn't do it faster.
But I've now a costly suit, and just your size.
In the King's coach you're to ride,
With the Princess by your side;

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Make love to her, and praise her beauteous eyes.
And, master, list to me!
Whate'er you hear or see,
Be very sure you never show surprise.

[Curtain.]

Act III. Scene I.

SCENE: Interior of Ogre's castle. PUSS-IN-BOOTS discovered.

PUSS: I'm here at last!
Much danger's past;
But such long tramps my liking
hardly suits;
Twas wisdom when I guessed
That it was surely best
To secure these blessed, helpful
old top-boots.
I was made to understand
That all this beauteous land
Belonged to this man-eating old
Wolfgang;
But as down the road I sped,
To each laborer I said:
Your life upon your answer now
doth hang.
When the sovereign comes
this way,
When he questions, you,
straightway,



Wolfgang: "Blood and thunder!"

"This land belongs to Carabas," must say.

[Awful growling and noise heard, and WOLFGANG enters.]

WOLFGANG: Blood and thunder!
Who, I wonder,

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Sent me such a tempting pussy-cat for dinner?
I can't under-
Stand the blunder;

But I'm glad, my pussy-cat, that you're no thinner.

PUSS: M-e-o-w! My brother Wolfgang (ah, how rich!)
I wouldn't have believed
You so easily deceived.
Know that I am Catoscratch, the witch.

WOLFGANG: Rattledy bang!
Snake and fang!

So you're a witch, all skilled in herbs and roots!
My power is no less,
But I must confess

That I ne'er before this saw a cat in boots!

PUSS: Meow! my brother, speak not of my skill:
'Tis true I can change to a cat, but no more,
While fame says that you can assume at your will
Any form that you please, be it higher or lower.
Many a league,
With much fatigue,
From a country of ice and snow,
On my broomstick steed
Have I come, with speed,
These great wonders to see and know.

WOLFGANG: Cuts and slashes!
Blood in splashes!
Who dares doubt what I can do?
Now tell me, old witch,
Of the many forms, which
Shall I take to prove this to you?

PUSS: Meow! my great Wolfgang, it seems to me that
Of all 'twould be hardest to turn to a rat!

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[WOLFGANG must be drawn backward toward the light. This will cause his shadow to grow to immense proportions. After slowly lifting him over the candle, take up the RAT and just as slowly put it over the light, and move the puppet up until it touches the cloth. The audience will see WOLFGANG swell up to a shapeless mass, and then, apparently, reduce himself to a tiny rat. PUSS must then be made to pounce upon the RAT, and by passing the RAT behind PUSS, and then letting it drop, it will look to the audience as if PUSS swallowed the RAT whole.]

PUSS: Bah! Ugh! Spat!
What a horrid rat!

[Struts up and down the stage.]

Well, I think for a cat I'm pretty plucky!
Now I'll go and bring
The Princes and the King
To the castle of Lord Carabas, The Lucky!

[PUSS, dancing frantically, laughing and purring, nearly tumbles against the KING, CARABAS, and the PRINCESS, as they enter.]

PUSS: Pardon, most gracious Sire, pardon, great King!
That your humble servant should do such a thing;
It's because I'm delighted,
More than if I had been knighted,
That the marquis, my master, should entertain the King.

KING: A truly faithful servant you must be, Pussy.
 When the marquis can spare you, come to me, Pussy.
 We'll see that you're not slighted;
 Even now you shall be knighted—
 Sir Thomas Cat de Boots your name shall be, Pussy.

KING (continuing to CARABAS):

This castle, marquis brave,
 Beats the very best we have.

CARABAS: Most gracious Sire, there's not a thing
 Belongs to me —

[PUSS rushes frantically to CARABAS, and whispers in his ear; then returns.]

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CARABAS: But to my King.

For my life and all I have to thee I owe.

KING: My Carabas, we're pleased:

Our mind is cheered and eased,

For we feared that this great castle held a foe.

'Tis a princely home, 'tis true.

And we'll make a prince of you.

You shall wed my charming daughter, ere we go.

PUSS: M-e-o-w! M-e-o-w! M-e-o-w!

What would say his brothers now,

If they saw Lord Marquis Carabas the Great?

And until the last horn toots

(With Sir Thomas Cat de Boots),

He shall occupy his present high estate

[All dance. Curtain.]



"A rat? Bah! what's that?"

CHAPTER XXXVII.

HOW TO MAKE A MAGIC LANTERN—A KALEIDOSCOPE—A FORTUNE-TELLER'S BOX, ETC.

UPON opening his eyes late one summer morning the author was very much startled and astonished at an apparition he beheld upon the wall. He saw at one side of the room, in a waving circle of light, a horrible, gaping monster that was about to make a mouthful of a wriggling, big-headed creature, as large as a cat. Upon turning over in bed and facing the window, the cause of this strange phenomenon was seen. The "gaping monster" proved to be a tiny gar, and the wriggler nothing more nor less than a tadpole. The curtains of the window had fallen down upon each side of a glass globe in which some aquarium pets were quarrelling. A ray of the morning sun had found its way into the darkened room through the fish globe, and by some unaccountable means transformed the globe into a sort of magic lantern lens and slide, throwing the magnified reflections of the inmates of the aquarium upon the wall. The gradual change in the position of the sun caused the vision to fade away in a few moments, and the writer has never since

been able to arrange the light so as to reproduce the same effect. Fortunately, however, some one else has discovered the principle, and from it evolved a simple magic lantern, which any boy can make for himself; an account of this invention lately appeared in the *Scientific American*, and the editors of that paper have kindly consented to allow the description to be used for the benefit of the "American Boys."

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All that is required for this apparatus is an ordinary wooden packing-box, A (Fig. 212), a kerosene hand-lamp, B, with an Argand burner, a small fish globe, C, and a burning-glass or magnifying-glass (a common double or plano-convex lens), D. In one end of the box, A, cut a round hole, E, large enough to admit a portion of the globe, C, suspended within the box, A, with the lamp, B, close to it. The globe is filled with water, from which the air has been expelled by boiling.

Now moisten the surface of a piece of common window-glass with a strong solution of common table salt, dissolved in

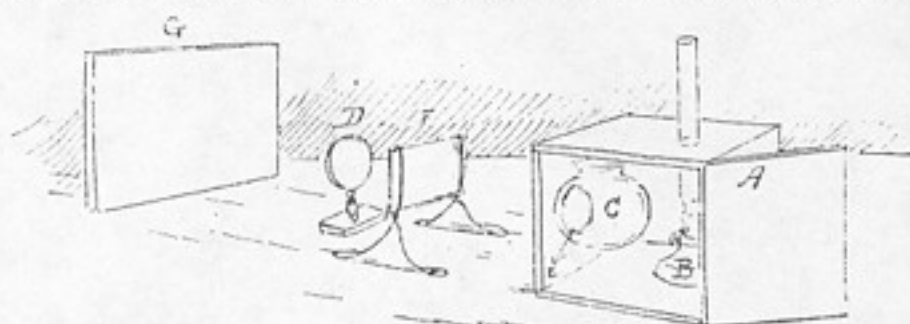


FIG. 212.—A Magic Lantern.

water, and place it vertically in a little stand made of wire, as shown at F, so that the light from the lamp, B, will be focused on it by the globe, which in this case answers as the condenser. The image of the glass will then be projected on the wall or screen of white cloth, G, providing the lens, D, is so placed in the path of the rays of light as to focus on the wall or screen. In a few minutes the salt solution on the surface of the glass, F, will begin to crystallize, and as each group of crystals takes beautiful forms, its image will be projected on the wall or screen, G, and will grow, as if by magic, into a beautiful forest of fern-like trees; it will continue to grow as long as there is any solution on the glass to crystallize. Then by adding a few drops of any transparent color to the water in the globe, the

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image on the screen will be illumined by shades of colored light. If the room in which the experiment is performed be very cold, frost crystals can be made by breathing on the glass, F. Many other experiments will suggest themselves, and when tried will be found both entertaining and instructive.

A Home-made Kaleidoscope.

At all glaziers' shops there are heaps of broken glass, composed of fragments of what were once long strips, cut with the diamond from pieces of window-pane, when fitting them for the sash. If you secure three of these strips of the same size, and tie them together in the form shown by Fig. 213, the

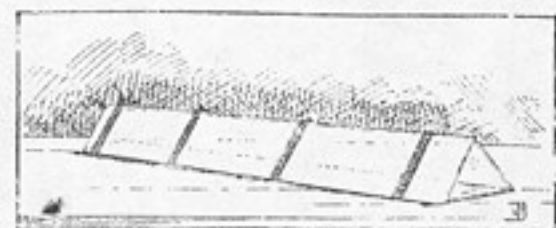


FIG. 213.—Kaleidoscope.

strings will keep the glass in position. Cut a piece of semi-

transparent writing-paper in the form shown by Fig. 214, so that it will fit on one end of the prism. With mucilage or paste fasten the overlapping edges to the glass; then with dark or opaque paper make another piece to fit upon the opposite end of the kaleidoscope; the opaque end-piece should have a round hole in its centre about the size of a silver twenty-cent piece—this is for the observer's eye. All that now remains to be done is to cover the sides of the apparatus with the same paper used for the eye-piece, and the kaleidoscope is finished.

FIG. 214.—End Piece of Kaleidoscope.

Drop a few bits of colored glass, beads or transparent pebbles in and turn the writing-paper end to the light; place your

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eye at the hole cut for that purpose in the opaque paper end, and as you look keep the prism slowly turning; the reflection in the glass will make the objects within take all manner of ever-changing, odd, and beautiful forms. A kaleidoscope made in the manner described is as serviceable and produces as good results as one for which you would have to pay several dollars at a store. One of the home-made ones can be manufactured in ten minutes if the pieces of glass be of the same length, and need no trimming to make them even.

The Fortune-Teller's Box.

There exists in all countries a class of people who make their living out of the proceeds derived from tricks and deceptions practised upon the ignorant, credulous, or superstitious portion of the population.

In the by-streets of almost any large city may be seen signs posted up on dingy-looking houses, which, if they were to be believed, would lead us to think that the gifted race that live in these dwellings can, by the aid of spirits, fairies, or by the signs in the heavens, give accurate information of all past or future events.

Some of these so-called mediums make such bungling attempts at magic and necromancy that it is a wonder that they are able to deceive any one. Others, however, perform some really wonderful tricks.

With a little trouble and no expense any boy may fit himself out as a fortune-teller, and have an unlimited amount of fun with his friends, who may be mystified and puzzled by simple contrivances, which, if explained to them, would be immediately understood. The professional fortune-teller will take persons into a dimly lighted room and ask if they wish to see their future wives or husbands, as the case may be; of course they do. The witch then leads them up to a table, which

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has an apparatus on top arranged so as to allow the dupes to peer in for a sight of their lover. When they really see what appear to be live, moving figures inside the tube, they go their ways rejoicing, fully convinced that there is truth in magic. One of these fortune-teller boxes can be made of any old wooden box. Such as is used for soap or candles is generally about the proper di-

mensions.

Knock one end of the box out, and cut a square hole in the lid in which to fit an inverted L-shaped apparatus. The L should be open at both ends, but tightly closed upon the four sides. A small mirror must be fitted in the L at the angle (see B, Fig. 215), and the L fitted in the square hole in the top of the wooden box in such a manner that any image cast upon the large looking-glass, A, in the wooden box, will be again reflected in the smaller mirror, B, at the angle in the L, and from thence to the observer's eye when placed at the open end of the L. This can best be arranged by experiment. The open end of the wooden box must fit closely in a square hole cut in the parti-

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tion or curtain that separates the young magician's apartment from a room or closet occupied by an accomplice. Cover the box with a cloth which has a square hole in it, and fits snugly around the bottom of the L, covering and concealing the suspicious-looking, large box beneath. If the work has been neatly done, the machine will look like an ordinary table or stand with an innocent-looking peep-box on top of it.

Secure some friend for an accomplice, whom you know to possess a ready wit and a knack for "making himself up," with the aid of burnt cork and a few old clothes, so as to take any comic character that the occasion may require, with only a few moments' notice.

Supply him with what wardrobe he may require, burnt corks, flour, etc., and then fix up the programme between you, so that the boy behind the screen will know just what to do, from listening to what is going on in front, at the fortune-teller's box.

When all is arranged, the fortune-teller may announce to what friends or visitors he may have, that, owing to the conjunction of certain planets, he is enabled to entertain them by showing to all who have any desire or curiosity to see such wonders, glimpses of the past and future, and to prove it, if any of the company would like to behold a life-like, moving image of a future wife or husband, he (the fortune-teller) can bring up the image in a magic telescope, which was obtained from a direct descendant of Aladdin. The young magician must, by preconcerted arrangement, bring a man or boy out for a first peep. At a private signal of a word or exclamation, the accomplice steps in front of the open end of the wooden box behind the partition, dressed as an old colored lady. The image is at once reflected upon the mirror at A, and from that to B, thence to

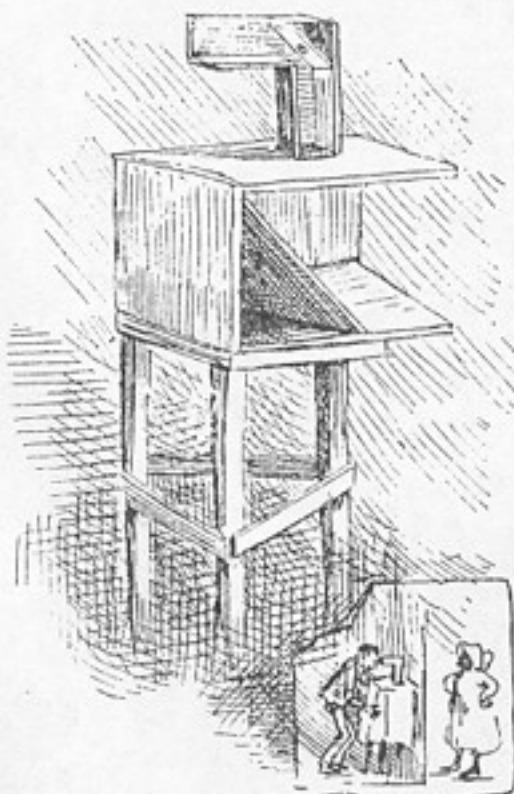


FIG. 215.—Construction of Fortune-Teller's Box.

the observer's eye. After the latter has had a good look, the rest of the company may be asked to take a peep and see their

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fortunate (?) friend's choice for a wife. When they see the old colored lady there will be a great laugh, in which the boy upon whom the joke has been played will join with all the greater zest, because he knows he will soon have a chance to laugh at some one else. The fortune-teller must guard with zealous care the secret of the box, and must discourage any too curious persons from handling or examining the apparatus. A little mystery is necessary to keep up the fun.

The Magic Cask.

After the fortune-teller has amused his friends sufficiently with his magic telescope, he may end the *séance* by inviting the company to another room and bidding them remain at the door while he examines something at the other end of the apartment—the something is covered with a cloth. Upon reaching the object, the magician must turn suddenly and face the guests in the doorway, and, in vehement language, accuse them of doubting the reality of the visions he has conjured up for them, stating that he overheard some among them say that it was nothing but a trick. Rather than be accused of such deception, he, the great wizard, prefers to perish! At this part the conjurer must quickly remove the cloth concealing the object in the corner, and disclose a barrel, marked in large letters, Gunpowder! Striking a match, the seemingly desperate wizard applies it to a fuse that hangs from the bung of the barrel, and, assuming a tragic attitude, awaits



FIG. 216.—The Magic Cask.

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the result. The guests will be uncertain what to do, and, half in doubt whether to laugh or run, they will probably stand their ground, but anxiously watch the fuse as the light creeps up toward the bung of the terrible cask of gunpowder. When the fire reaches the barrel there is an instant of suspense; then some one in the secret lets an extension-table leaf fall upon the floor in the hall or adjoining room, startling the guests and making a loud noise; instantly the staves of the barrel fly apart and fall upon all sides of the head, radiating out like the petals of a sunflower, from the centre of which the fortune-teller's accomplice steps forth and greets the company.

How the Barrel is Made.

Any cask or barrel large enough to hold a boy in a crouching position will do to manufacture a magic barrel from. To make one of these trick-boxes requires no particular skill. It is necessary to remove one head for the top, and, after joining the parts of the other head firmly together by cleats nailed upon the inside (see Fig. 168.—Snow-ball Warfare), burn a hole with a red-hot poker through each stave near the bottom, then burn corresponding holes through the bottom head; make the staves fast to the bottom by tying them with pieces of heavy twine. Around the top of the staves of the barrel tie another piece of

twine; remove all the hoops, and all that will hold the staves together will be the twine at the top (see Fig. 216); as soon as that is severed, the staves will fall asunder. Inside the barrel the accomplice crouches with open pen-knife in hand, and at the proper time he cuts the string by passing the blade of his knife between two staves. Left without support the barrel staves fall, exposing the gentleman within to the frightened spectators, who, when they discover that there really was no gunpowder in the cask, will welcome the new-comer most heartily.

In amateur theatricals the magic cask can be brought in very

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effectively with the aid of a red light and appropriate ceremony. The audience may be led to expect a most terrible explosion, and with bated breath watch the fuse as the light slowly creeps up nearer and nearer to the bung of the cask. When the time comes as much noise must be made as possible; then, as the staves fall on all sides and spread out like a sunflower, a red light suddenly thrown upon a boy dressed like a scarlet imp, makes a pretty as well as a mirth-provoking transformation scene.

Before exhibiting it, the barrel should be tried to see that it works properly, and the boy in the barrel should rehearse his part, and not forget to have a sharp-bladed knife ready to cut the cord at the given signal, otherwise the whole scene will fall very flat.

CHAPTER XXXVIII.

HOW TO MAKE THE DANCING FAIRIES, THE BATHER, AND THE ORATOR.

THE guests are led to a room, which is discovered to be dimly lighted and apparently unoccupied; they are then told that it is the fairies' night, and that although the little people are incapable of appearing in their natural form so as to be discernible, yet on certain nights of the year the fairies are willing to enter into and animate artificial figures made for their use. While talking in this style, the performer must borrow three or four pocket-handkerchiefs from the guests, and, after bidding the latter be seated, proceed to make the handkerchiefs up into little figures.

How to Make a Handkerchief Doll.

Roll up both edges of the handkerchief, as shown by Fig. 217. Fold the end A over toward the end B, as shown by Fig. 218. Next draw the end B up between the corners of A until the handkerchief takes the form illustrated by Fig. 219. Bring the ends of B under C, and tie them in a simple knot, allowing the ends to project as in Fig. 221, which shows the back. The handkerchief now has the appearance of a little white man (Fig. 220—front view).

After the handkerchief men are finished, the company must be requested to stand or sit where they are, near the door, and on no account to move for fear of frightening the little people. Carrying the handkerchief dolls to the middle of the room, under

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the chandelier, and making some passes over them, the magician leaves the figures sitting upright upon the floor. One of the company may be then asked to play upon the piano. No sooner does the first note struck upon the instrument sound through the room, than signs of life become noticeable among

the handkerchief figures; they move, and, one by one, rise and stand. As the music becomes lively the handkerchiefs lose

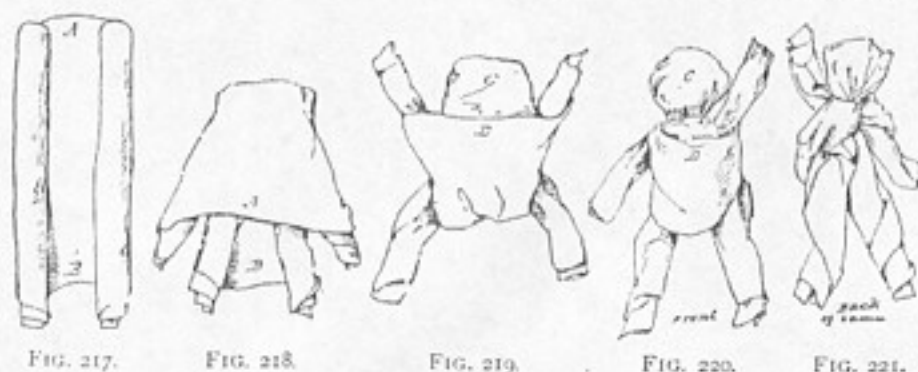


FIG. 217. FIG. 218. FIG. 219. FIG. 220. FIG. 221.
Evolutions of the Handkerchief.

their diffidence and dance about in a very active manner. After the dance is over the handkerchiefs are returned to the owners and the room vacated, to give the *fairies* an opportunity to rest, and the *children*, that have, during the performance, been hiding behind the furniture, an opportunity to make their escape unobserved. The children are as necessary as the handkerchief dolls, for it is by means of silken threads in the hands of the little folks that the fairies are made to dance and move about. For each handkerchief there is a piece of thread long enough to reach over the chandelier down to the floor. Each piece of thread terminates in a hook made of a crooked pin. While the magician is making the customary passes, he deftly hooks the figures on to the pins. Old and worldly wise people have been completely mystified by this simple little trick.

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In any attempt at magic or fortune-telling, the success of the experiment depends more upon the manner in which the deceptions are performed than upon the tricks themselves. The magician or fortune-teller must be a person not liable to become flustered and confused at any little mishap. A boy with a cool head and ready invention can smooth over the most palpable mistakes and make his audience believe them all in the programme.

The Bather

is sure to produce a laugh whenever exhibited by a clever person. The preparations must be made in an apparently careless manner, so as not to attract attention. Tie a simple knot in the end of a handkerchief and let it rest against

the knuckles of the left hand, while the rest of the handkerchief dangles below, as in Fig. 222; do this as if you were only absent-mindedly playing with your pocket-handkerchief. Wrap the handkerchief around your two first fingers, as in Fig. 223; then, as if you had just thought of it, ask the company if they ever noticed how becoming the bathing costumes are to most people, adding, that to you a bather running down the beach always looks like this—here you make the little figure run rapidly along your lap or the table-



FIG. 222.—First position of Handkerchief.



FIG. 223.—The Bather.

top toward the company (Fig. 223). The ends of the fingers

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protruding from below the white handkerchief look exceedingly comical, while the knot on top will be at once recognized as the bather's head, done up in a handkerchief or towel to keep the salt water out of the hair. If among the company there be any who are familiar with the scenes at seaside summer resorts, they will be convulsed with laughter. Some people can entertain a company for a whole hour with nothing but a glib tongue and a pocket-handkerchief.

The Orator.

This comical little toy can be made by a boy who has really no knowledge of drawing.

From some colored chromo or illustrated paper cut out an appropriate face and paste it on a piece of card-board, as in the accompanying illustration (Fig. 224). Where the arms are to be, cut two holes large enough to admit two fingers of your hand. From a piece of dark cloth cut two pieces shaped like the front of a coat and paste them on in the proper place (Fig. 224). Cut another triangular piece of cloth for the vest; let it be red or some bright color. Paste the vest on as shown by the diagram;

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make a collar by drawing the outlines as in the illustration and leaving it white between them; any bit of bright ribbon will do for the necktie. Draw a couple of straight lines beneath the figure to represent the top to a speaker's stand. From the same

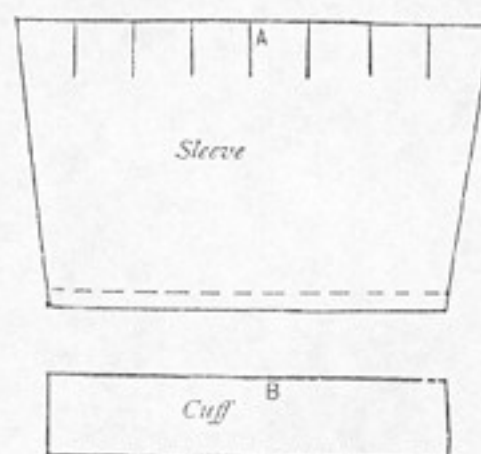


FIG. 225.—Pattern of Sleeve and Cuff.

material that is used for the coat cut two pieces of cloth, of the shape shown by Fig. 225, A, for the sleeves. Let them be of such length that when the top edge is folded back the distance of the vertical cuts shown on the diagram, and the sleeve wrapped around the forefinger, the end of the finger will protrude the length of the nail. Sew or paste the edges of the sleeves together and put the slit ends (A, Fig. 225) through the arm-holes cut in the card-board; bend back the slits and paste them upon the back of the card-board. Make the cuffs of white paper (Fig. 225, B), and fasten them inside the sleeves by a few stitches of thread. The orator is now finished and ready to deliver his oration. Hold the card up in front of you and thrust your first two fingers through the sleeves. The flesh-colored tips of your fingers peep-



FIG. 224.—The Orator.

ing from beneath the white cuff look like little fists, and when the fingers are moved around in mimic gestures, the effect is comical beyond measure and will create a laugh wherever exhibited. If the picture-head of some well-known public man can be procured, it will add greatly to the effect produced upon the audience. A comical speech should be prepared and recited with accompanying movements of the arms (fingers). The little man can be made to scratch his nose, roll up his sleeves, and go through many other movements in a most natural and life-like manner.

CHAPTER XXXIX.

HOW TO MAKE VARIOUS AND DIVERS WHIRLIGIGS.

WHO can watch machinery of any kind in motion, without experiencing an indefinable sort of pleasure? No matter how simple the contrivance may be, if it move it immediately interests us. This instinct, if I may so call it, that prompts us to watch and play with machinery is implanted in the brain of the lower animals as well as of man. I think no one can doubt that a kitten or a dog enjoys chasing a ball, and enters into the sport with as much zest as a college-boy does his game of football. It is this same indefinable desire for observing and experimenting with moving objects that prompts us to throw stones for the purpose of seeing them skip over the surface of the water, and to this instinct must be attributed the pleasure experienced by the school-boy with his



The Potato Mill.

Potato Mill,

which consists of simply a stick, a potato, a buckeye, or a horse-chestnut, and a string. The stick is whittled into the form shown in the illustration; a string is fastened to the stick about one-half inch below the knob on the top. The buckeye has a

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large hole bored through the middle, and a small hole bored through one side, to the middle hole; the string from the stick passes through the hole in the side of the buckeye; the end of the stick is sharpened and thrust into a potato.

If the string be wound around the stick, and the buckeye held between the thumb and forefinger, the stick and potato may be made to spin rapidly by alternately pulling the string and allowing it to slacken; the motion imparted by the first pull continues long enough to wind the string in the opposite direction, and thus, for an indefinite time, or until the string wears out by friction, the potato mill may be kept buzzing at a great rate.

Another machine the boys used to be very fond of was called

A Saw-Mill;

it was generally made out of the top of a tin blacking-box, with the rim knocked off and the edge cut into notches like a saw. Two strings passing through two holes near the centre gave a revolving motion to the "buzzer" (Fig. 226 shows a saw-mill).

By holding the strings



FIG. 226.—A Saw-Mill.

so that the wheel hangs loosely in the middle, and swinging the wheel or "buzzer" around and around until the string becomes tightly twisted, the machine is wound up. As with the potato mill, the revolving motion is imparted by alternately pulling and allowing the string to slacken, only in this case you must hold one end of the string in each hand (Fig. 226). When the boys can make a buzzer actually saw into a piece of board or shingle by allowing the edge of the wheel to strike the wood, the saw-mill is pronounced a success, and its value increased.

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Very pretty and amusing toys may be made on the same principle as the saw or potato mills described. One of these little machines, a very fascinating one, is sold upon the streets of New York by the novelty peddlers. As the writer was passing along Broadway the other day, he saw an old acquaintance, known to almost all New Yorkers by the name of "Little Charlie." Little Charlie is not a small man, as his name might imply, but a large, good-natured, red-faced peddler, who stands all day long at the street corners. During the winter he sells small india-rubber dolls, crying out to the passers-by: "Well! well! well! Little Charlie! double him up! double him up!" He doubles the little india-rubber dolls up in a comical manner to attract customers. The torrid summer heat is too much for the india-rubber dolls, and makes them sticky, so that they are laid aside during the hot weather, and Little Charlie, with the perspiration streaming from his face, no longer calls out in his accustomed manner, but stands silently twirling his summer novelty, trusting to the ever-changing colors of the toy to attract purchasers. One was bought that it might be introduced among the other whirligigs in this chapter.

The Rainbow Whirligig.

If you have a pair of dividers, make a circle upon a piece of card-board about two inches in diameter; inside this circle make six other circles (Fig. 227).

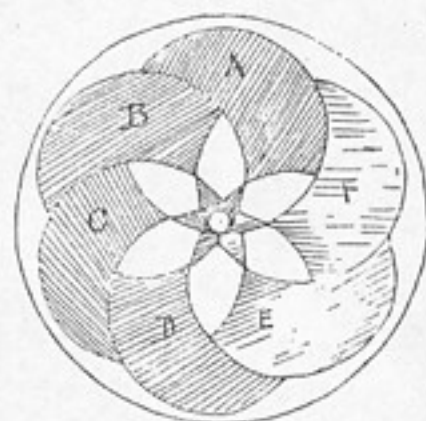


FIG. 227.—A disk of the Rainbow Whirligig.

A pair of scissors can be made to do the duty of a pair of dividers by spreading them apart the required distance and thrusting the points through a card to hold them in position (Fig.

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228). Make a duplicate figure or disk and paint the parts of the inside circles, shaded in the diagram, different colors; for instance, A and D may be made blue, B and E green, C and F red. The points of the star in the centre made by the intersection of the circumference of the circles should be painted the same color as the parts of the circle adjoining. Upon the second disk paint A and D blue, B and E yellow, C and F red.



FIG. 228.—A Pair of Dividers.

Cut a piece of one-quarter inch pine into a square, with sides of about two and one-quarter inches in length; cut off the corners as shown by I, Fig. 229. In a hole in the centre of

I fasten tightly the round stick J. Whittle out another piece for a handle K, and bore a hole through the top for the stick J to fit in loosely; bore another hole through one side for the string to pass through. In the illustration, as in the original from which the drawing was made, there is a large hole bored through two sides; but this is unnecessary, and only put in the diagram to better show the position of the string inside. Upon the wooden plate I, describe a circle about one and three-quarter inches in diameter. In the centre of the two paper disks make holes large enough to fit with shoe-eyelets; then with tacks (L, Fig. 229) fasten the two paper disks on to the wooden plate at the points G and H, in such a manner that the tack passing through the eyelets

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will allow the disks to revolve freely. Attach a string to the stick J at a point that will come opposite the string-hole in the side of the handle, when the stick J is slid into the hole at the top of the handle K. The wooden disk is made to spin exactly in the same manner that motion is imparted to the potato mill already described. When in motion the colors on the paper disks will blend and produce, with each change of position, a number of beautiful variations. The two paper disks blend together, making a large circle three and one-half inches in diameter, composed of concentric rings of the most lovely hues—red, pink, purple, green, and all the different shades and combinations imaginable are portrayed with ever-changing variety by the spinning rainbow whirligig.

A Paradoxical Whirligig

is a very ingenious toy, consisting of a circle of white card-board, upon the surface of which any number of black rings are painted, one within the other, until it resembles an archery butt or target.

The disk is tacked or glued securely to a stick or handle (Fig. 230) so that it is impossible for it to really revolve, yet if you grasp the toy by the handle and give your arm a motion similar to that of the shaft of an engine, the disk upon the stick will appear to revolve like a wheel, and so closely does the optical delusion resemble actual motion that it will deceive almost any one who is not familiar with the experiment.

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A picture of a wagon, with wheels made like the disks of the paradoxical whirligig, may be made, and the wheels will have all the appearance of revolving when a wabbling motion is imparted to the picture. There are many curious experiments that can be tried in this line—spirals may be made to twist around; pictured machinery may be given the appearance of actual moving wheels, etc. The philosophy of all this is best explained in the

description of the next whirligig.

The Phantasmoscope, or Magic Wheel.

The phantasmoscope, or magic wheel, is comparatively simple, consisting, as may be seen by the accompanying illustration, of a disk of any diameter revolving upon a pin in the centre. Figures in different poses of arrested action are painted or pasted upon the one side; under each figure is an oblong opening or slot. Much amusement can be derived from this old and simple toy. We herewith give one with the correct positions of a horse trotting a 2:40 gait, drawn in silhouette upon the outer margin of the wheel.

Make a careful tracing of the illustration (Fig. 231) with a lead-pencil upon tracing-paper; reverse the tracing-paper upon a piece of card-board so that the side with the pencil-markings on it will be next to the card-board; after which fasten both card-board and paper to a drawing-board or table-top with tacks, so that neither tracing nor card-board can slip. With the point of a hard pencil, a slate-pencil or any similar instrument, go carefully over each line of the tracing as seen through the tracing-paper; be careful not to omit a single mark; it is very provoking to discover, after removing the tracing-paper, that part of the drawing is wanting; but if you have been careful, when the tacks are removed you will find the picture neatly transferred on the card-board. Go carefully over each line on the

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card-board with a pen and black ink, and fill in the outlines of each picture with ink, making a silhouette of the figures.

Cut the phantasmoscope, or magic disk, out, following the



FIG. 230.—Paradoxical Whirligig.

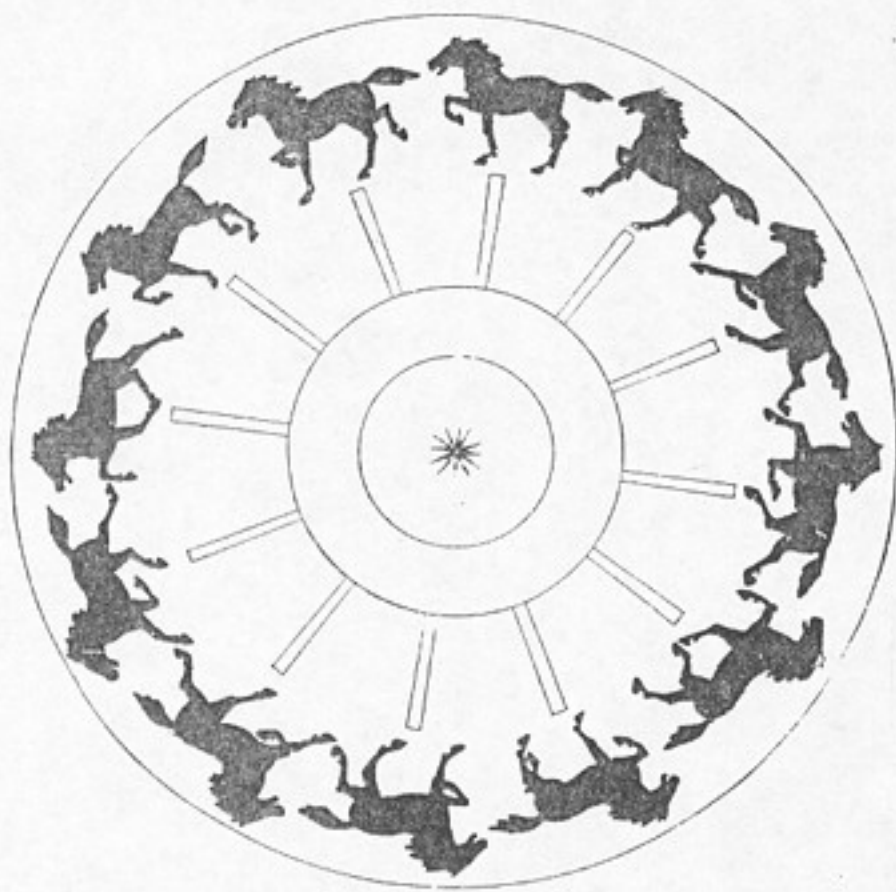
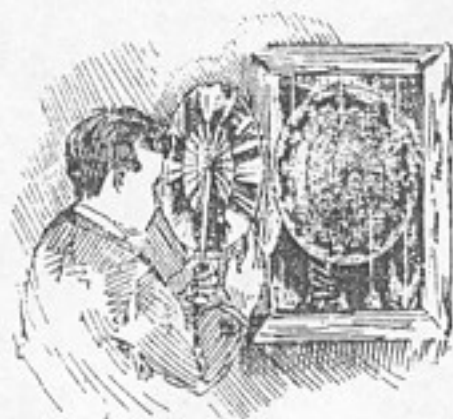


FIG. 231.—The Magic Wheel.

outer circle with the scissors, and under each figure, where the oblong places are drawn, cut a corresponding opening through the pasteboard. Fasten the wheel to a stick or handle by means of a pin at its centre, on which it can freely turn.

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If a larger machine be wanted, the illustration here given may be enlarged by the process described on page 250. To use the magic wheel, stand in front of a mirror, as shown in the small illustration; hold the disk before the eyes; look through the slots under the figures, and turn the wheel rapidly. The horses' legs will commence to move as in life, and as each successive position drawn upon the phantasmoscope is the exact



Making the Horses Trot.

one taken by a trotting horse, the horses in the mirror will all appear to be in actual motion, on a fast trot. If the eye is directed over the margin of the paste-board disk, an indistinct blur is all that is seen. The principle is generally well known and easily explained. It pertains to the phenomenon known as the persistence of vision. When the eye is directed through the

slot, the figure of a horse is seen for an instant as the opening passes the eye, and the impression is retained after the object is shut off by the intervening portion of the board between the slots until another horse appears through the succeeding opening, when an additional impression is made, the same as the preceding impression, except a slight change in the position of the legs. These impressions follow each other so rapidly that they produce upon the retina of the eye the effect of a continuous image of the horses, in which the limbs, replaced by a succession of positions, present the appearance of a file of horses in actual motion.

The instantaneous photographs taken nowadays of people, horses, and other animals in motion, opens a new field for inves-

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tigation, and one which, with the aid of the simple toy described, will be found very entertaining as well as instructive.

Mr. Muybridge's celebrated photographs of animals in motion can all be adapted by smart boys to home-made phantasmoscopes, and it will probably not be long before the wonderful photographs of birds and bats on the wing, taken by E. J. Marcy with his revolving photographic gun, will be within reach of the public. Then with the magic disk the reader can make birds fly, horses trot, men ride bicycles, and reproduce every movement as correct as in nature.

For young scientists these beautiful experiments will be found very entertaining.

CHAPTER XL.

THE UNIVERSE IN A CARD-BOX.

A JOVIAL-LOOKING commercial traveller once won a wager from the landlord of a certain Detroit hotel by making over a hundred rings with one mouthful of smoke. The writer was sitting in the hotel office at the time, and becoming interested in the conver-



Smoke-Rings.

sation, watched to see how the trick was done. Taking some cards from his card-case, the young man proceeded to bend up the edges in such a manner that the centre part of each formed a perfect square. Six cards he folded in this manner; then, after fishing in his pockets for some time, he produced a dime and a lead-pencil. Placing the ten-cent piece upon the centre of one card, he made a ring with the lead-pencil by following the edges of the coin. Opening a pocket-knife at the file blade, with the point he cut a round hole in the card, following the circle made by the pencil. He then put the cards together, in the form of a light but strong box (Figs. 232, 233, 234, and 235), and taking a long pull at a cigar which was

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between his lips, he filled his cheeks, and blew the smoke into the paper box. By this time all the idlers in the office had collected around the smoker, who, with a triumphant smile upon his face, commenced to tap the sides of the box with his lead-pencil. At each tap a tiny but perfect and beautiful ring of smoke shot into the air—one hundred and ten were counted before the smoke was exhausted. Fig. 236 shows how similar rings can be made with a lamp-chimney in which a card disk with a hole in it has been placed; a piece of paper or membrane fastened over the other end serves for a vibrating surface, which, when struck with the thumb, forces out the little rings of smoke.

The reader must not for a moment suppose that it is necessary to use tobacco smoke to perform this beautiful experiment; any other smoke will answer just as well to make the "vortex rings," as they are scientifically called. If after dipping a paint-brush into india ink, or any water-color paint, you gently insert the tip of the brush into a glass of clear water, you will see the pigment fall from the end of the brush, and, gradually sinking to the bottom, form rings exactly similar to the circles of smoke described.

The rings made by skipping a flat stone over the water are but another example of the vortex, and the jolly commercial traveller, when he was exhibiting the little paper box and

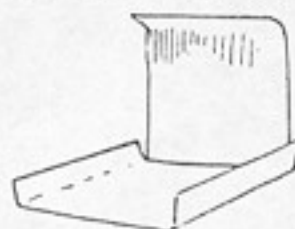


FIG. 232.



FIG. 233.

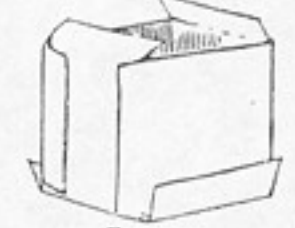


FIG. 234.

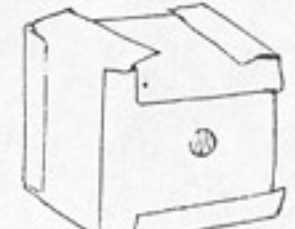


FIG. 235.

How to make a Card-box.

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smoke-rings to the laughing crowd of fellow-travellers in the

hotel office, was standing upon the threshold of a mighty mystery, experimenting with laws, and showing the action of the



FIG. 236.—Lamp-Chimney
Smoke-Box.

same forces that are supposed to have produced the wonderful rings around Saturn! Indeed, it is asserted that the broad, misty band of light which we see at night stretched across the heavens, and known to every boy as the milky-way, is nothing more nor less than a gigantic vortex ring, composed of millions of heavenly atoms. Some very learned men think that the secret of the whole universe, the origin of gravitation and electricity, are all locked up in the mystery which controls the formation and motion of a simple smoke-ring.

As Adrien Guebhard wisely remarks, in an interesting article upon this same subject, "Nothing is vulgar to one who knows how to see, and nothing indifferent to one who knows how to observe."

CHAPTER XLI.

LIFE INSTILLED INTO PAPER PUPPETS, AND MATCHES MADE OF HUMAN FINGERS.

MANY strange and unaccountable occurrences are attributed by ignorant people to "animal magnetism," some even going to such an extreme as to refuse to shake hands with other persons for fear of parting with some of their precious magnetic properties. Where there is much smoke there must be some fire, as the old adage goes, and although the marvellous stories current in a certain class of literature are wholly untrue, animal electricity undoubtedly exists. All boys who use a comb to smooth out their tangled locks upon a cold winter morning, no doubt hear and wonder at the crackling of the electricity as the comb passes through their hair. Many of my readers have probably tormented poor puss by holding her in a dark closet, and watching the sparks fly from her fur as, with a pitiless hand, it was briskly rubbed the wrong way until a severe scratch or bite from the cat warned them that she took no interest in such scientific experiments. A less cruel and more entertaining experiment is to cut out a lot of little paper figures, and the next cold day, when your hair begins to snap and stand on end in its effort to follow the electrified comb, hold the comb over the figures; the little puppets will immediately appear to be endowed with life and commence to jump and dance, or stick to each other and to the comb (Fig. 237), as if fastened by glue.

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Often one little figure will stand on his head, and another, fixing himself by one hand, hold his tiny form upright in a most comical manner; sometimes they will form themselves into long strings and go through all manner of queer and seemingly intelligent movements. The same result can be produced by rubbing a piece of gutta-percha smartly upon a

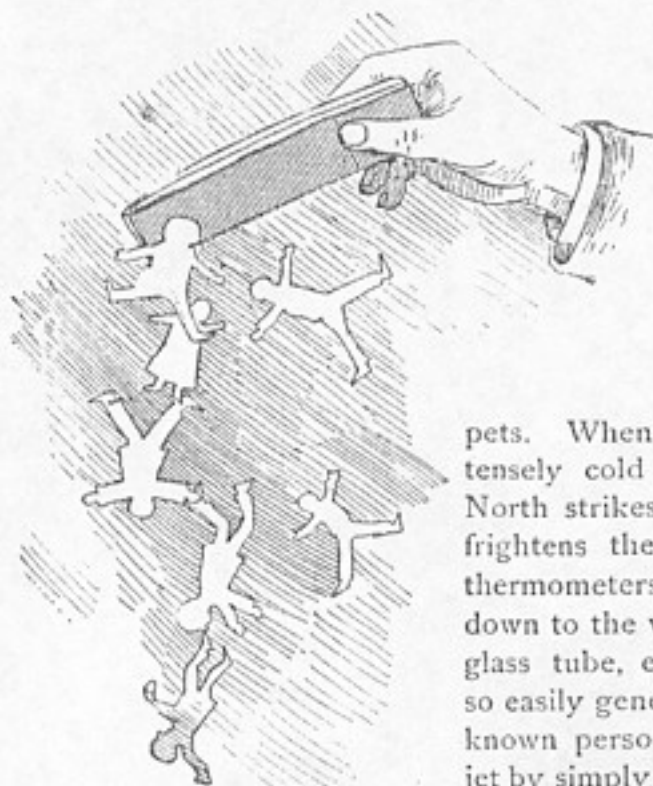


FIG. 237.

piece of woollen cloth, and then holding it over the paper pup-

pets. When one of those intensely cold waves from the North strikes the country and frightens the mercury in the thermometers, until it retreats down to the very bottom of its glass tube, electricity is often so easily generated that I have known persons to light a gas-jet by simply applying the ends of their fingers to the burners.

A certain professor, well known to the public, was so startled at seeing the gas blaze up upon touching the burner with his finger, that he dropped into a sitting posture upon the floor, and there, with his feet spread apart, and his eyes and mouth open, he presented a perfect picture of astonishment and wonder.

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To Light the Gas with your Finger,

turn it on without applying a light, walk around the room, sliding your feet over the carpet, until you again reach the burner, touch the tip of the burner and instantly the light will blaze up as if by magic.

From what has been already said, the reader will understand that the gas-jet experiment is only successful under peculiar conditions of the atmosphere. Do not try to turn on the gas with one hand and light it with the other, for as soon as the first hand touches the metal key the electricity is expended, and there is none left in the other hand to ignite the gas. Turn the gas on first, walk around the room in the manner described, and touch nothing with your hand before it is applied to the burner.

There are many other experiments that may be tried by boys interested in this subject, but as they necessitate more or less complicated and expensive instruments they are omitted, it being the object of this book to describe only such things as can be manufactured by the boys themselves.

CHAPTER XLII.

HOME-MADE MASQUERADE AND THEATRICAL COSTUMES.

The White Man of the Desert.

IN 1876 quite a large party were returning from New Orleans to St. Louis on board the largest of Mississippi steamers. Every night was devoted to merriment, in which all joined,



passengers and officers. One morning, large posters, made with colored chalk on brown paper, and hung at both ends of the cabin, announced a grand masquerade as the programme for the evening.

As a rule, masquerade costumes are not to be found aboard Mississippi River steamers, yet, that evening,

when the band struck up a march, every stateroom door opened, and from each doorway issued some queer or fantastic figure. One costume in particular was so simple, and yet so complete, as to be noteworthy. A boy had taken two sheets from his

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berth, and, by wrapping one around each leg, fastening them at the ankles with strings and at the waist with a shawl-strap, made quite a presentable pair of Turkish pants. The shawl-strap, worn with the handle in front, had the appearance of an odd-looking double belt; a pair of white stockings, drawn over a pair of slippers and the bottom of the pants, answered for white boots; his shirt served as a white waist. A sheet hanging from his shoulders, after the manner of a cape or shawl, combined, with a turban made of a towel, to give a decided Arab look. The boy's face and hair had been made snowy white by an application of flour.

The disguise was complete, and the costume pronounced by all to be the very best in the cabin. In a similar manner many characters may be personated, and the costume made up of such material as can be found about home.

Many proposed tableaux, masquerade, or parlor play is abandoned because the costumes necessary are either unattainable or altogether too expensive.

There is "lots of fun" to be had at entertainments of this kind and for fear that my reader might miss some such opportunity to have a "good time," this chapter is devoted to describing two or three costumes, and showing how first-class character dresses can be made without an expenditure of money.

"The Fourteenth Century Young Man"

can be clothed with modern garments altered to suit the occasion. Tights are necessary, and may be made of an ordinary suit of knit underclothes (Fig. 238) by the addition of a little trimming and a pair of trunks to cover the top part of the drawers. But let us commence at the top of the man and work down, describing each article of dress in the order in which it comes.



The Fourteenth Century Young Man.

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The Mediæval Hat.

Soak an old felt hat thoroughly in hot water; put it over the top of some blunt-ended object, a bed-post, for instance, and,



FIG. 238.—Fourteenth Century Costume, Untrimmed



FIG. 239.—Stretching the Hat.



FIG. 240.—The Mediæval Hat.

grasping the brim with both hands, pull down steadily and firmly until the crown becomes elongated to the proportions of the

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ones belonging to the hats worn by the clowns in the circuses (Fig. 239). In stretching the hat be very careful not to tear the felt. Turn the brim up in the back and pull it down in front.

Fasten a long feather of any kind, a chicken or turkey feather will answer, to the back of the hat, and let the plume droop over the front, as shown by Fig. 240.

The Wig.

To make this you will probably have to ask your mother's or sister's assistance. Induce one of them to make a cloth skull-cap of the shape shown by Fig. 241. Cover, and sew to



FIG. 241.—Skull-Cap.



FIG. 242.—Spanish Moss Wig.



FIG. 243.—Excelsior Wig.



FIG. 244.—White Cotton Wig.

this cap Spanish moss or "curled horse-hair," such as is used by upholsterers (Fig. 242). Cotton or excelsior will make very respectable wigs when nicely arranged and sewed on to neatly

fitting skull-caps (Figs. 243 and 244).

Eye brows, Moustache, and Beard

can be made of white or black cotton, fastened to the face with a little mucilage.

The Doublet,

to be in keeping with the mediæval hat, must fit quite closely, and an ordinary knit undershirt is just the thing, especially if

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it be a bright-colored garment. At the neck fasten a broad white collar, a piece of lace or a ruff, borrowed for the occasion from some lady friend. From the same source procure a large bow of ribbons to fasten at the throat and conceal the band and button on the front of the shirt. If ruffs or lace cuffs be added to the sleeves, the doublet will be complete, and the shirt so disguised that no one will suspect its true character (see Fig. 245).



FIG. 245.—The Doublet.

Take any pair of old pants and cut them off at the knees; if they are a trifle too large for you, they will make all the better trunks.

Let the same lady friend that made the skull-cap, hem the bottom of the pants. The hem should be strong enough to hold strings within for drawing the bottoms tightly around the limbs (Fig. 246).

If you do not wish to impose too much upon the good na-



FIG. 246.—Trunks.

ture of your lady friends, you may put the strings in the pants yourself after the manner shown by Fig. 247.

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Half a dozen slashes cut in the trunks through which some bright-colored cloth is allowed to show, adds greatly to the general appearance.

Tights.

A pair of knit drawers arranged with straps that pull the bottoms of the drawers over the insteps and heels of the feet, make as good a pair of tights when worn with trunks as any that can be rented from the costumer, and they are much more pleasant to wear than the often uncleanly hired garments (Fig. 248).

To Dress.

First put on your stockings; then pull on the tights, allowing the straps to fit under the foot. Next put on the trunks, and pull the bottom of the legs of the latter garment up as high as possible, draw the strings



FIG. 248.—Leg with Tights.

Trunks.

and tie them tightly, this will make the trunks puff out and spread open the slashes. Next put on the doublet, and allow it to fall outside the trunks. Slippers or low shoes should be worn.

A friend and myself once made a couple of suits like the one just described, using red knit underclothes for tights and white flannel pants slashed with red for trunks. Red-covered shoes and red feathers in our hats completed the costumes, which were exactly alike in every particular. So closely did we resemble each other when masked and dressed in these home-made garments, that our most intimate friends were unable to distinguish one from the other.

The Baby

is a mirth-provoking disguise when well personated. To transform yourself into a baby, remove your coat and vest,

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and, after procuring two long white skirts, fasten one at your waist, and let the waist-band of the other come just under your



FIG. 249.—The Baby.

arms, so that this skirt will fall over the first one adjusted. Let some one tuck up your shirt-sleeves to the shoulder, and run ribbons through them and out at the neck, tying the ends in bows at the shoulders. To do this, the shirt must be opened at the throat and the collar-band tucked under; this makes a low neck and short sleeves. A broad sash passed around under the arms and tied in a large bow-knot looks very baby-like (Fig. 249). The head should be covered with a hood.

The latter can be made of a piece of white cloth, or a large handkerchief folded in the following manner:

How to Make a Handkerchief Hood.

Fig. 250 represents the handkerchief. Take the corners A and B and fold them under, as shown by Fig. 251. Allowing the handkerchief to rest flat upon a table, turn the corners made by the fold over as you would in making a paper hat; this will give you Fig. 252. Again proceed as you would in manufacturing a paper hat, and turn the bottom C D up over A B; roll this bottom piece up and over about three times (Fig. 253). Pick up the handkerchief by the ends C and D, and you will have Fig. 254, a pretty and complete baby-hood, which, when it is put on the head, and the ends C and D tied under the chin, will conceal the hair, and besides adding to the baby look, it will help to disguise the person wearing it.

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Thus, I might go on until next year, telling how to make all manner of costumes; but I have sufficient confidence in boys to believe that, as a rule, they only need a hint or two to start them in any project, and that their own ingenuity will carry them through. So far I have carried my descriptions of boyish pastimes through the seasons, and I now halt at the recurrence of spring; not, believe me, for lack of matter, for suggestion breeds suggestion, until there seems to be no end, and my greatest difficulty has been to avoid devoting too great a space to any one topic.



FIG. 250.



FIG. 251.



FIG. 252.



FIG. 253.



FIG. 254.

No boy need hope to achieve success as a manufacturer of any of the objects described in this book unless he carefully reads the description and masters the details. Remember that even in sports and plays no slipshod, careless, and partial effort can avoid failure. As a rule, the best and most earnest worker is the liveliest and heartiest companion.

It is not without regret that the author bids farewell; and

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if the reader of this book derive half the enjoyment from the perusal that the author has from the writing, then the book is not a failure; and if what little that has been said encourage and help any boys—be they few or many—to appreciate, love, and enter into all sensible sports, as every true American boy should, then has this book fulfilled its mission.

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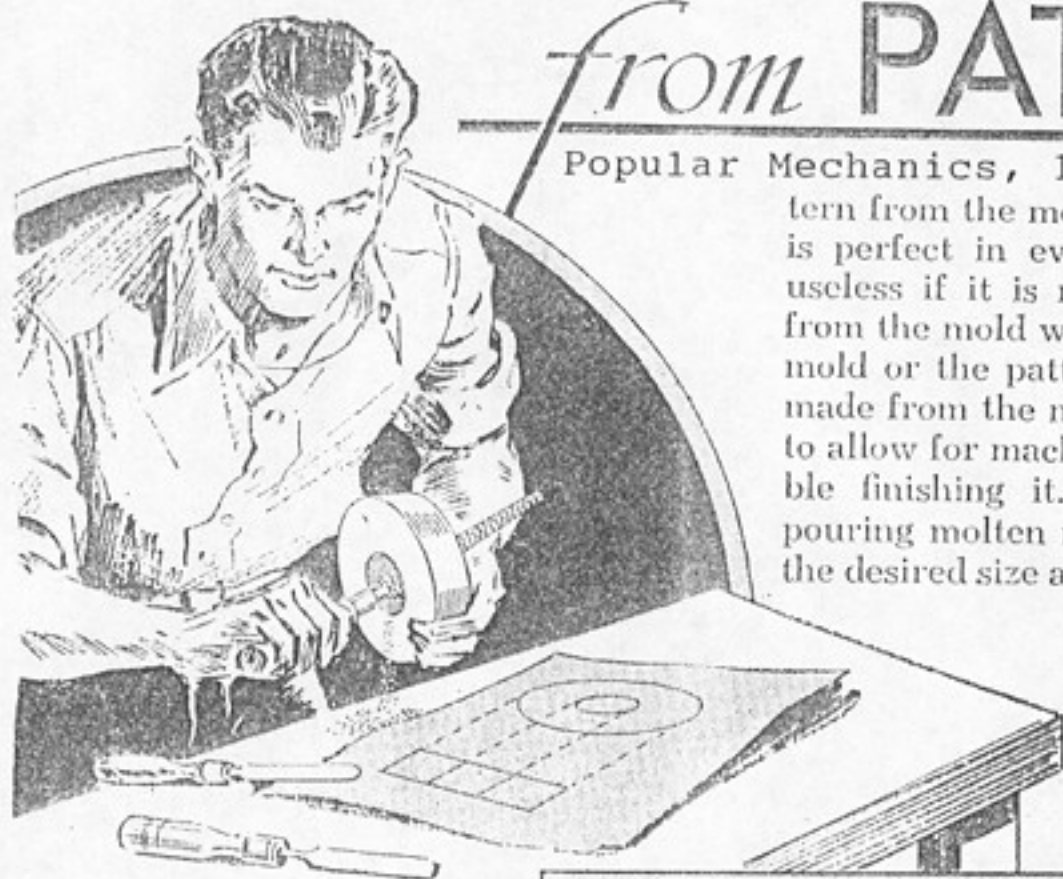
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from PATTERN

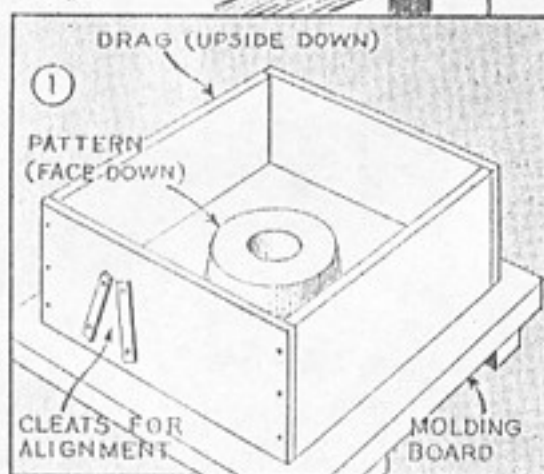
Popular Mechanics, 1940

tern from the molder's viewpoint, one that is perfect in every other respect is still useless if it is not possible to remove it from the mold without breaking either the mold or the pattern. If the rough casting made from the mold has insufficient metal to allow for machining you will have trouble finishing it. Castings are made by pouring molten metal into a sand mold of the desired size and shape, Fig. 4. The sand

is retained in a box open at the top and bottom which is called the "flask." The latter is made in two sections, the lower of which is called the "drag" and the upper the "cope." These are fitted with guides and cleats or dowels to permit accurate realignment of the two sections. The first steps required in making a mold from a one-piece pattern are shown in Figs. 1

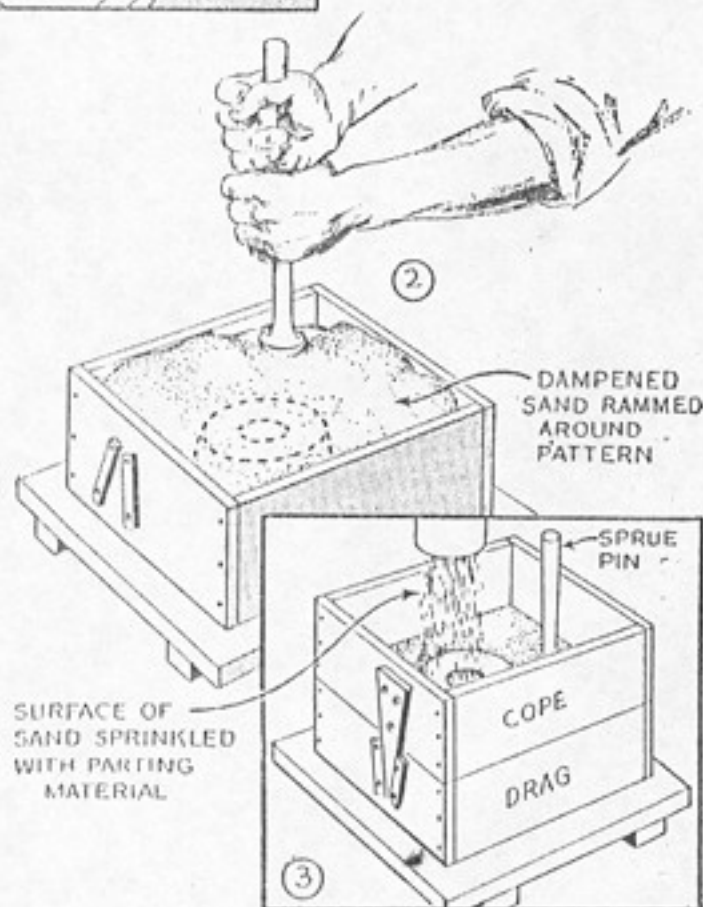
PART I

Tells how castings are made in the foundry in sand molds—how to make your own patterns—what woods to use—where to use fillets—how to make draft and shrinkage allowances with 'shrink' rule



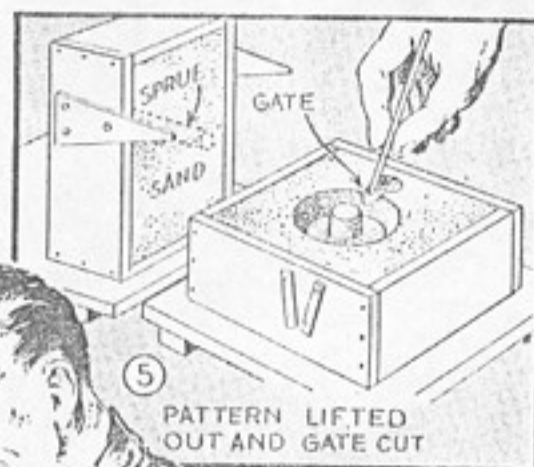
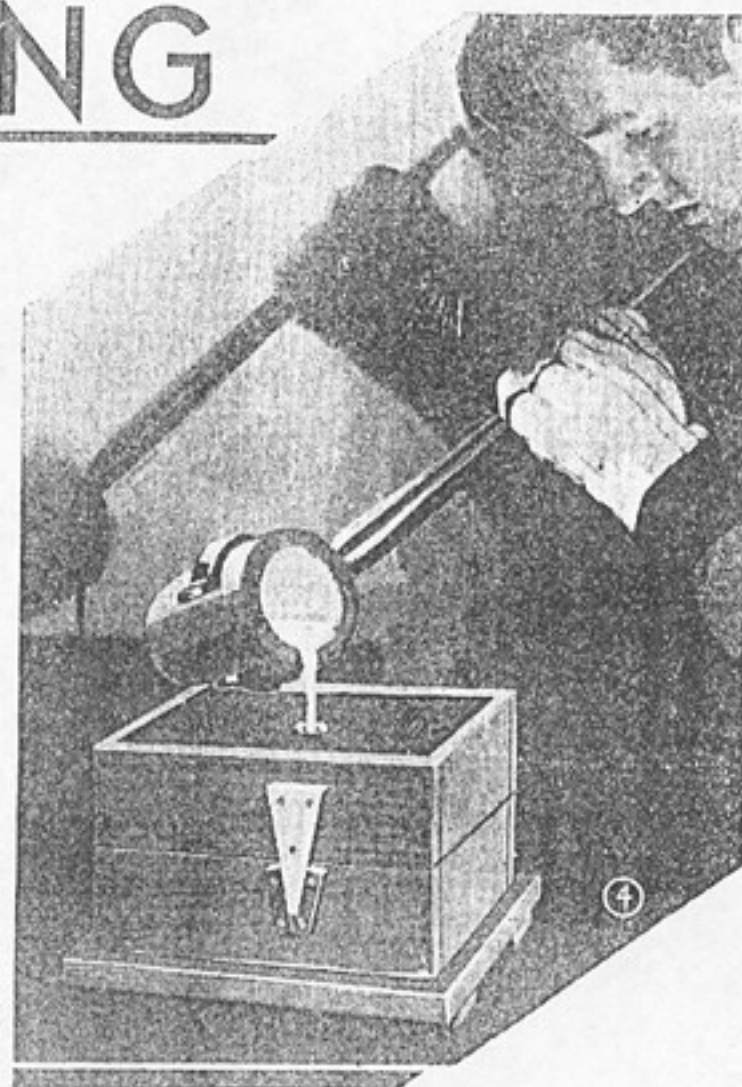
HOW often have you attempted to make up some metal part of stock materials and finally found that a casting would be much better for the purpose? Then, why not make a pattern and have a casting made from it that will be just what you want? Unless the casting required is complicated in detail or unusual in shape, the pattern needed will be a very simple affair. There's no need for fancy woods or elaborate equipment. Just a piece or two of pine and a few hand tools will serve the purpose where only one or two castings are to be made from the same pattern. However, it is necessary that the latter be laid out and constructed very carefully, for any errors in the pattern will be reproduced in the casting.

The pattern for a casting is simply a form or device from which a mold can be made that will produce a casting of the desired shape and size. Looking at the pat-



to CASTING

to 3. First the pattern is laid face down on the molding board, with the drag inverted around it. The sand, properly dampened, is rammed around the pattern until the drag is filled to the top and struck off level with a straight edge. The drag is then turned right side up on the bottom board and the surface is sprinkled with a parting material to prevent sticking. At the same time the second half of the pattern, if it is in two pieces, is set in place. The cope is set on the drag, a sprue pin is placed to form a pouring hole in the cope, and the latter is rammed with sand. It is then lifted off and the pattern is removed from both halves of the mold. After a pouring hole and gate for the metal are cut in the sand as in Fig. 5, the cope is replaced as in Fig. 6. This, in brief, is the common procedure. The pattern is invariably larger than the finished casting, and in all cases it is necessary that it be made with tapered sides, or "draft" as it is commonly called. This provision on the pattern makes it easy to remove from the mold without breaking up the print as in Fig. 7. Fig. 8 shows the same pattern constructed with the proper draft. The amount of draft that must



COPE REPLACED
ON DRAG, -READY
FOR POURING



be provided depends on the type of the mold and the location. Where possible, the pattern is made with the draft all running in one direction from the parting line, as at A in Fig. 9. In this case, and for the outside of the pattern, the amount of draft is generally $\frac{1}{8}$ in. to the foot, as in Fig. 10. Note also in this illustration that on the side of a casting,

where a hollow pattern is used, considerably greater draft is required. Generally a draft of $\frac{1}{16}$ in. to the inch is specified. If the opening is less than 1 in. in diameter, draft of $\frac{1}{8}$ in. to the inch must be allowed. Where this amount of draft cannot be tolerated on an inside surface, it is necessary to use a solid pattern and form the hole with a core. This will be explained in the second article of this series.

Another important provision with regard to draft applies to those cases where a pattern cannot be made in one piece, but is made in two pieces with

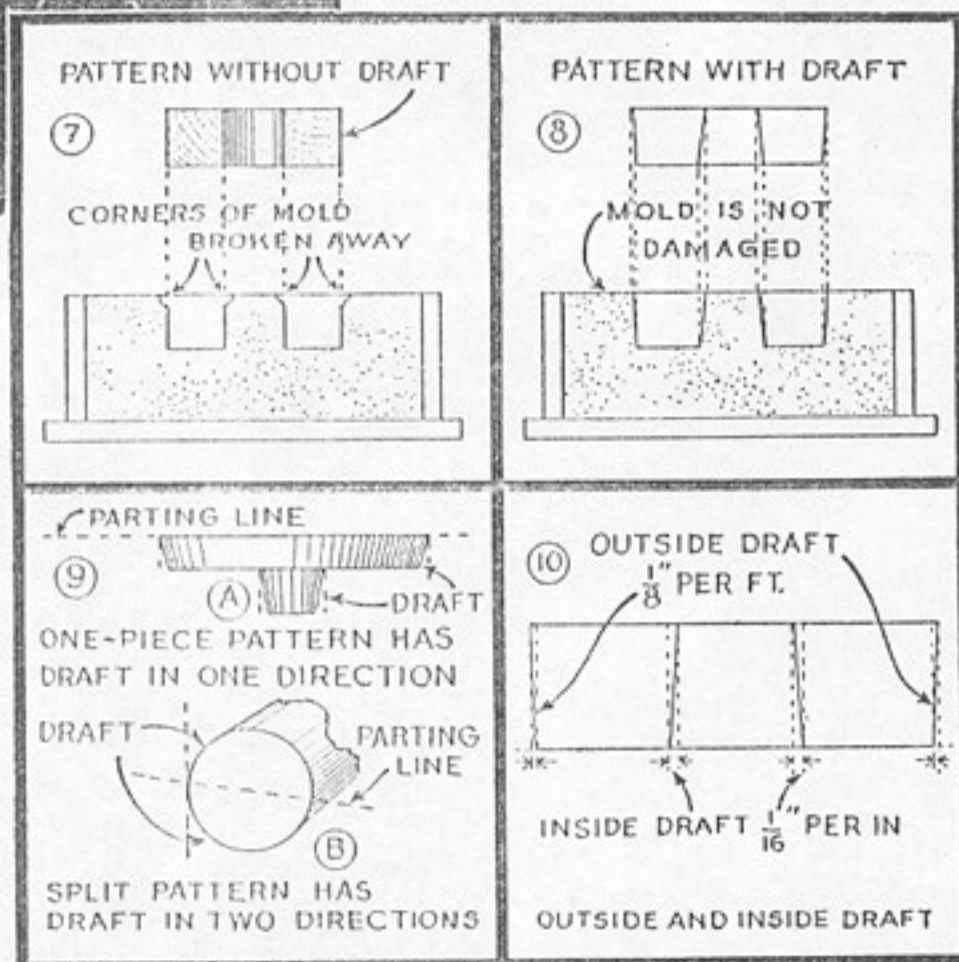


draft running in both directions from the parting surface, as shown in Fig. 9, B. Here it is necessary to double the draft on the section of the pattern that extends into the cope or upper section of the mold. This provision is made to assure easy parting of the pattern from the mold when the cope is lifted off the drag and the pattern is removed.

The second important characteristic that affects the pattern size is shrinkage. All castings shrink after solidification, the amount of shrinkage depending on the metal from which they are made. It is, therefore, necessary to make the pattern and mold somewhat larger so that the casting will shrink to the desired dimensions. Table I gives the approximate shrinkage for various common metals. To get this shrinkage accurately you simply lay out the pattern with a shrink rule instead of an ordinary rule. A shrink rule has each foot increased by $\frac{1}{8}$ in., if for iron, and by $\frac{3}{16}$ in., if for brass, and all subdivisions elongated proportionately. This saves the time necessary to calculate the shrinkage allowance on each dimension.

A third allowance which must frequently

be made is that for finish. The surface of a casting is naturally rough and somewhat irregular, and if two castings must be fitted together accurately, or if extreme accuracy is necessary for any other reason, the surface will have to be machined down to the finished size. Generally an allowance of $\frac{1}{16}$ in. is made for each finished surface on small castings, although for larger castings in which irregularities may be greater, a larger allowance for finish is needed. One more thing and you're ready to lay



out the pattern. Wherever wood parts of a pattern join at right angles a fillet is necessary, Figs. 12, 13, and 14. Triangular leather fillets are obtainable ready-made in a variety of sizes and are easy to apply with glue. On small patterns such as those used for model parts, beeswax is usually better. It is simply pressed into place then worked to a true radius with a spherical-ended tool as in Fig. 14. The tool must be heated slightly at intervals.

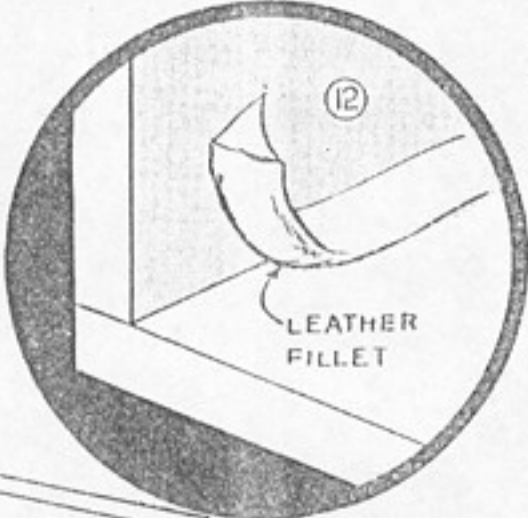
The best way to lay out the pattern is to make a mechanical drawing of the part to be made as in Fig. 15. Locate the surfaces to be finished and use the symbol "f" to

denote them on the drawing. This will help in remembering to make the proper finish allowances. Patternmaking woods should be well dried and seasoned. Redwood is sometimes used, also cherry, mahogany, or maple when the pattern will be subject to repeated use. For ordinary work, clear white pine will do very well. Where gluing is necessary use a hide glue applied hot, as in Fig. 11. If possible the layout should be made directly on the wood that is to be used for the pattern. The pattern should be planned in advance so that, if possible, the draft is all in one direction from the parting line. With this



TABLE I
Approximate Shrinkage of Castings

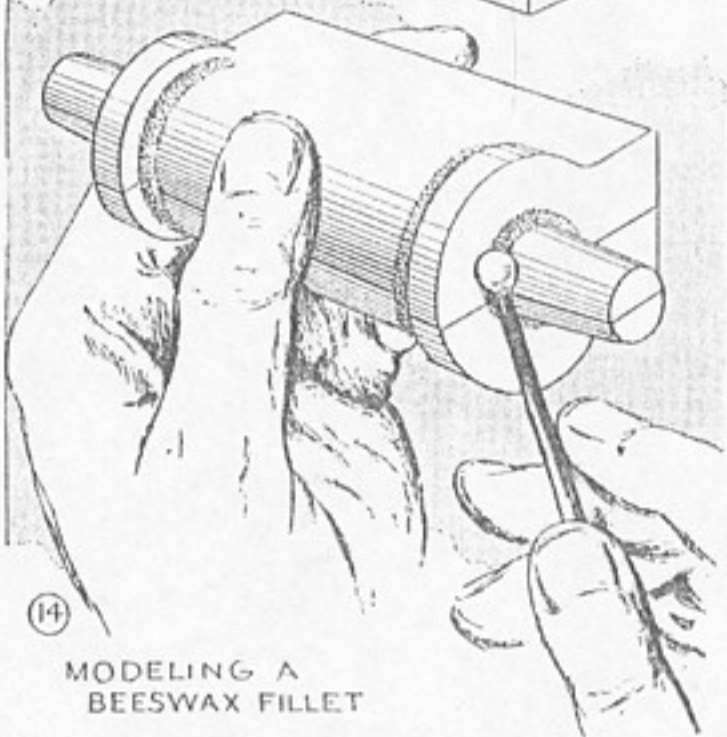
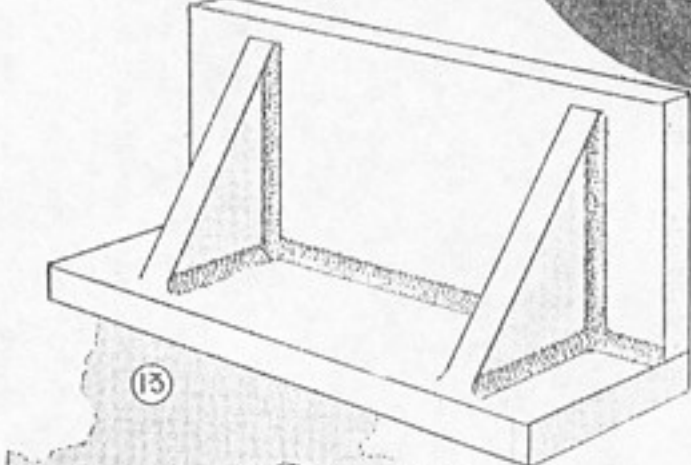
Cast iron	1/8 in.
Brass	3/16 in.
Aluminum	1/4 in.
Zinc	5/16 in.
Copper	3/16 in.
Lead	5/16 in.
Malleable iron	1/8 in.
Steel	1/4 in.



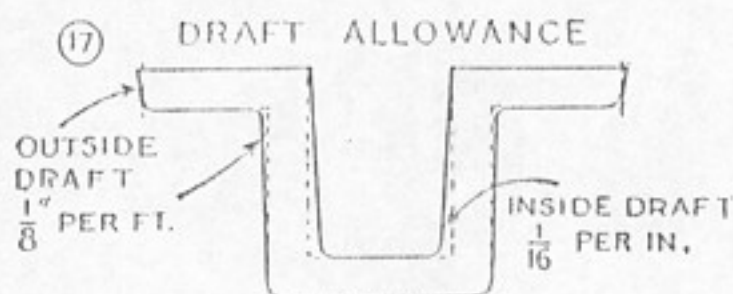
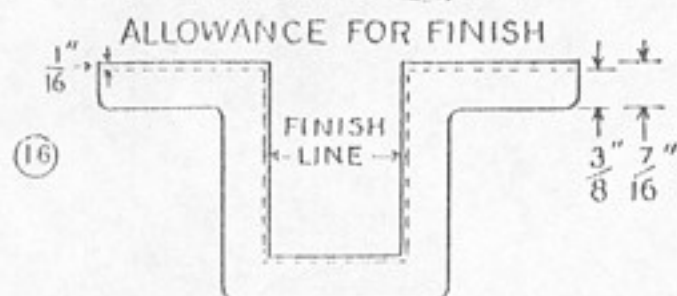
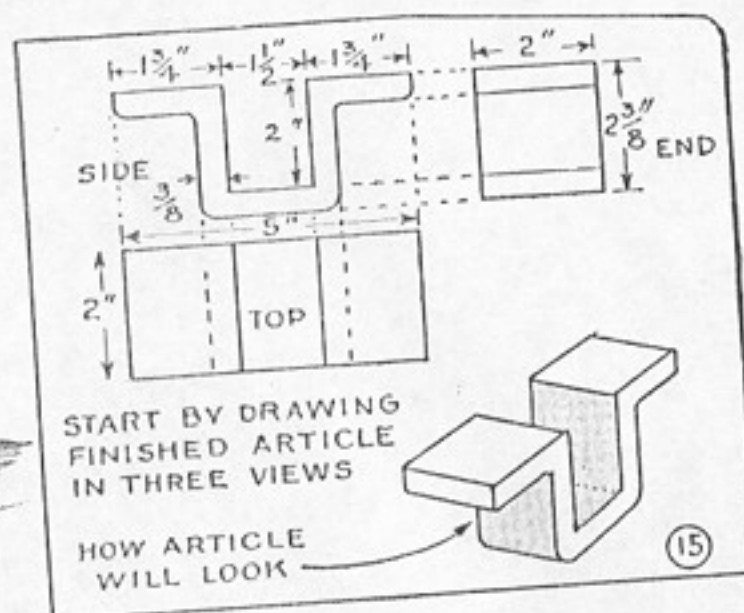
in mind, the layout is made, using a shrink rule for all dimensions and marking all lines with a sharp knife. It is best to start all measurements from the center line of the pattern, rather than from an edge; and to lay out any holes first before

laying out edges. The steps in laying out a pattern for a simple bracket are shown in Figs. 16, 17, and 18.

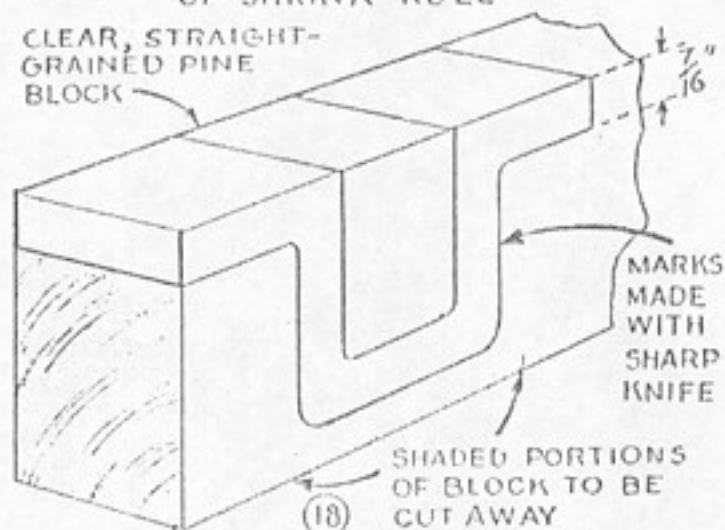
When the layout is completed, the excess wood can be removed by sawing and the pattern finished with chisels and gouges. Cylindrical or other round sections, of course, may be turned in a lathe. The work should be finished to exact size very carefully. The quality of the finish, especially on small wood patterns, is very important. All surfaces of the wood which come in contact with the sand must be glass-smooth before applying shellac. Where hand tools are used to cut away waste it is necessary to use care when you approach the finish dimensions or you may cut too deep and spoil the pattern. It is essential that surfaces worked down with edge tools be left as smooth as possible so that sanding will be reduced to the minimum. Slight cavities or shallow cuts made inadvertently under the finish dimensions can be filled with woodturner's cement or wood putty. Have your tools razor-sharp so that you can cut with or across the grain without



MODELING A BEESWAX FILLET



LAYOUT ON WOOD MADE WITH AID OF SHRINK RULE



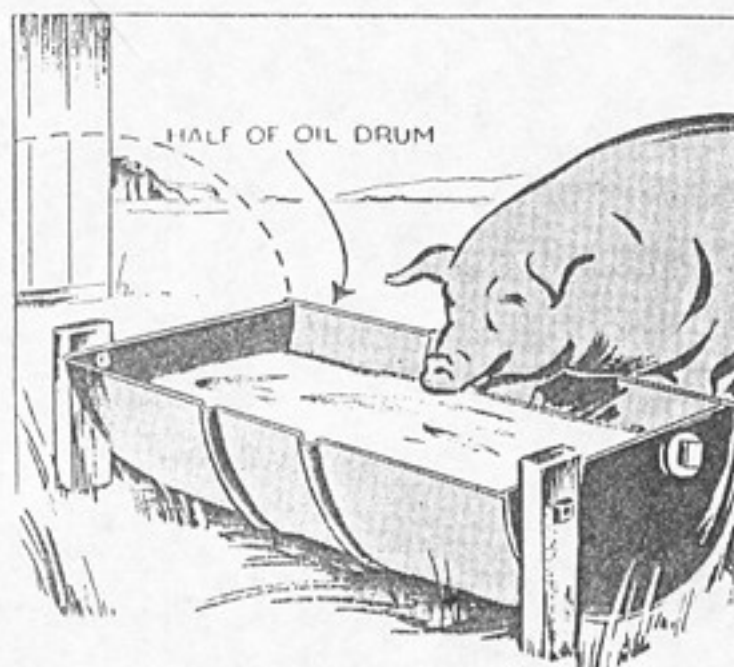
raising deep splinters. Sometimes a fine rasp is better than a chisel or gouge on the cross grain. The disadvantage of the rasp for general work is that it raises the fibers of the wood and leaves a rather rough surface which requires considerable sanding to smooth up. Lathe-turned patterns can be finished ready for shellacking with a minimum of hand work, of course. Some-

times small patterns are simply sanded and then dipped in melted paraffin to finish. Although not approved practice, this method frequently serves very well. In any case when the carving is finished, the pattern is sanded carefully with No. 0 or finer sandpaper and, as is the common practice, given two or three coats of orange shellac to protect it from moisture.

(To be continued)

Hog Trough from Oil Drum

Here is a hog trough that is cheap, can be emptied and cleaned easily, and that will not burst if liquids freeze in it. Made from half an oil drum, it is pivoted at the corners between stakes driven firmly into the ground. In this position, it is easy to overturn for emptying. After cutting the drum in half, it is a good idea to bend the edges over or round them with a file to avoid injuring the hogs.

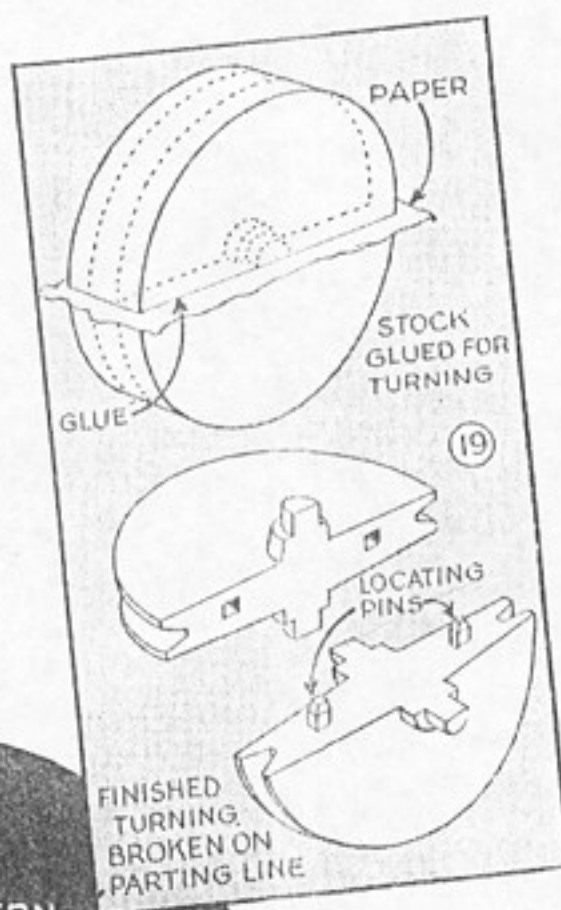


From PATTERN to CASTING

PART II

Two-Piece Patterns and Cores

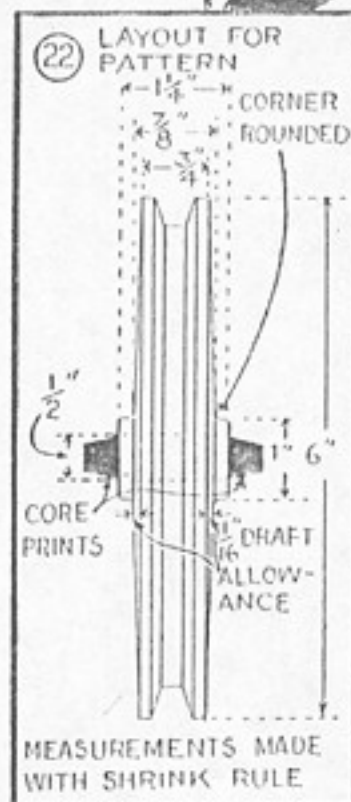
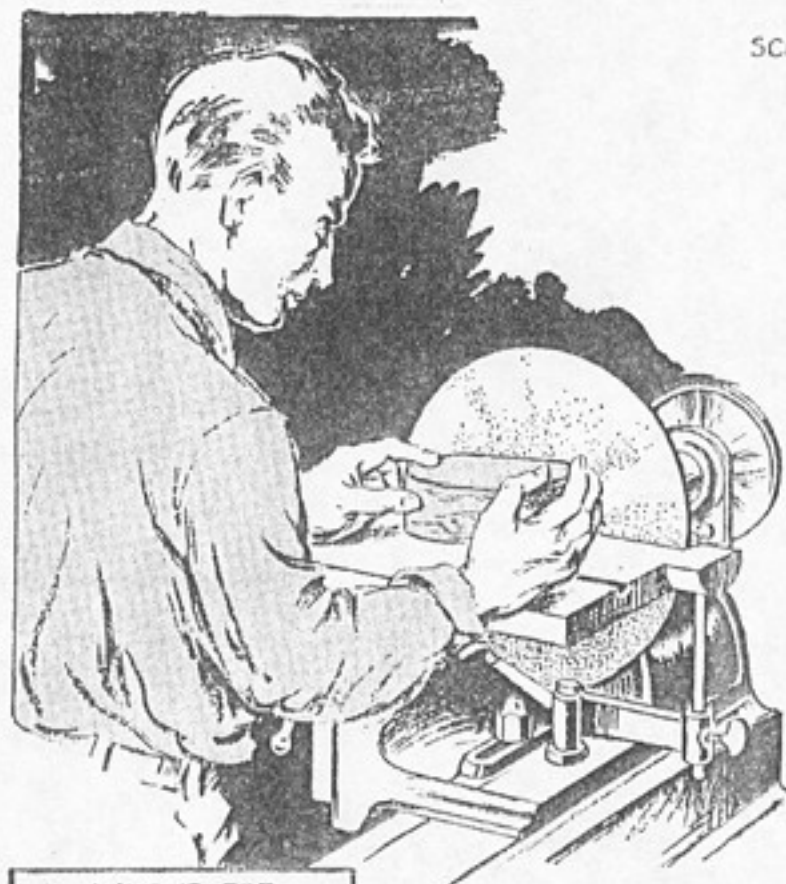
WHERE the pattern must be of such shape that it cannot be made with the draft running in one direction from the parting line, it is necessary to resort to a split pattern of two or more pieces. As an example of this type of pattern, take the small V-pulley shown in Fig. 19. As you will see this pulley has no recessed web or spokes, so it can be cast in the vertical position as in Fig. 20. The parting line in this case will be on the diameter of the pulley. The curvature of the wheel and the V-shape of the belt groove will provide sufficient draft on these surfaces. However, the flat outside surfaces will require draft. Keep in mind that the amount of draft will be not less than



$\frac{1}{8}$ in. to the foot for that part of the pattern below the parting line, while on the half of the pattern above the parting line (the cope section) the draft should be twice as great, or not less than $\frac{1}{4}$ in. per foot. This permits easy parting of the cope and drag when the mold has been completed.

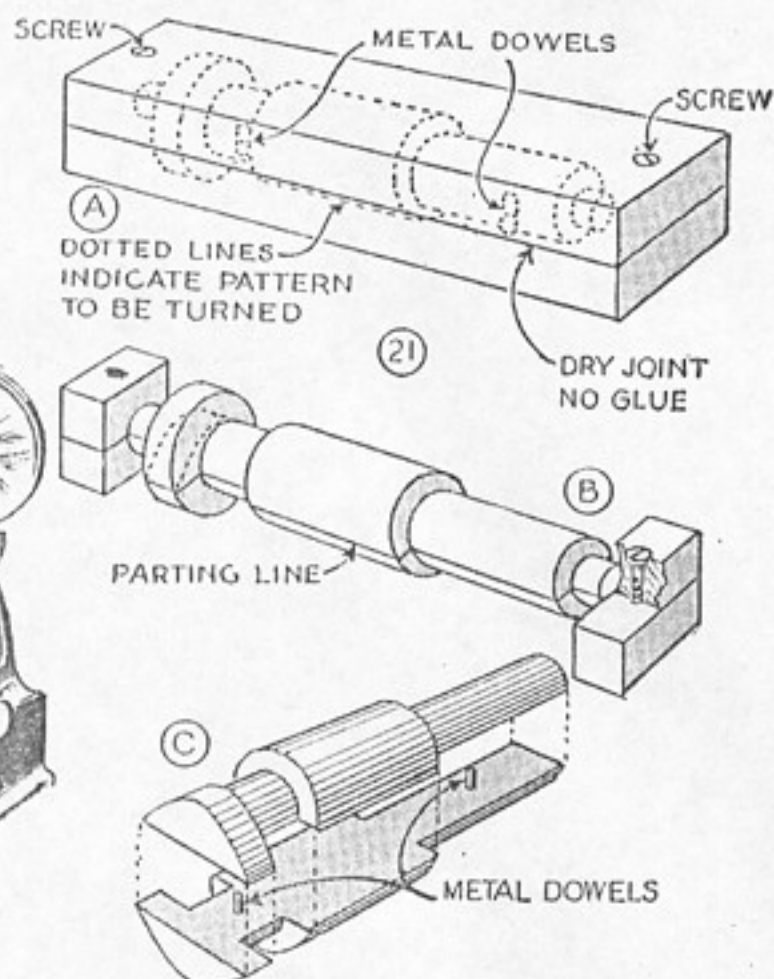
The layout of this pattern is made as shown in Fig. 22, and the method of turning it complete in the lathe is detailed in Figs. 23 to 26 inclusive. Irregular-shaped patterns are usually made with ordinary hand tools and carving chisels. In almost all cases of split patterns, it is best to make the pattern out of two pieces of clear white pine, the joint between the two parts corresponding to the parting line. If these two pieces are joined together with staples, corrugated fasteners, or screws in Fig. 21 A, B and C, the pattern can be turned or





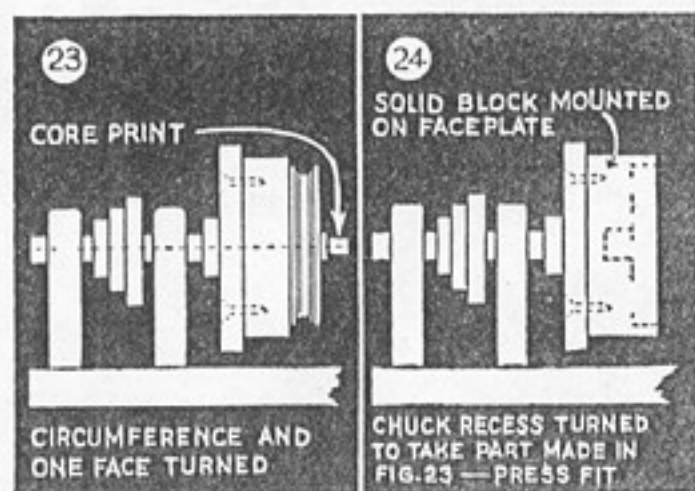
otherwise shaped as though it were in one piece. In those cases where it is not possible to locate staples or screws so that they will hold the parts together, the blocks can be joined by gluing with a sheet of newspaper between as in Fig. 19. This will give a good bond which can be broken easily when the job is completed without damage to the parts.

Before completing the V-pulley pattern you come to the matter of cores. Where a hole through the casting is required to have straight sides (without draft), or where it must be in such a position that it cannot be formed as a part of the pattern, the hole must be made by coring. In the case of this pulley the hole required for the shaft not only must be cylindrical, but it also would be impossible to form it with the pattern alone. For this reason it must be cored. Note the core prints in Figs. 19 and 22. These are simply projections from



the pattern which form openings in the mold by which the core is supported as in Fig. 30. In regular practice core prints are usually tapered slightly, but in individual work where pattern and core are used only once or at most, a few times, this is seldom necessary. In small work especially, they can be the same diameter as the core and, of course, should be in direct line with the core. Usually the combined length of the core prints should equal at least half the length of the cored hole for proper support. The core prints can be either integral parts of the pattern, or separate turned pieces fastened to the main pattern with screws or dowel pins. In this particular case it will be easier to make them as part of the pattern.

Dry-sand cores are usually made in a core box of the proper shape and then baked dry. A simple core box can be made by inserting locating dowels in two pieces of white pine as in Fig. 27. Cut the pieces to such length as you want the core, then staple them together and drill the blank lengthwise, as in Fig. 28. The two halves are then separated as in Fig. 29, and the surfaces lightly sandpapered and shellacked all over. If the core is not cylindrical or if its cross-section is not constant throughout the length, hand work will be

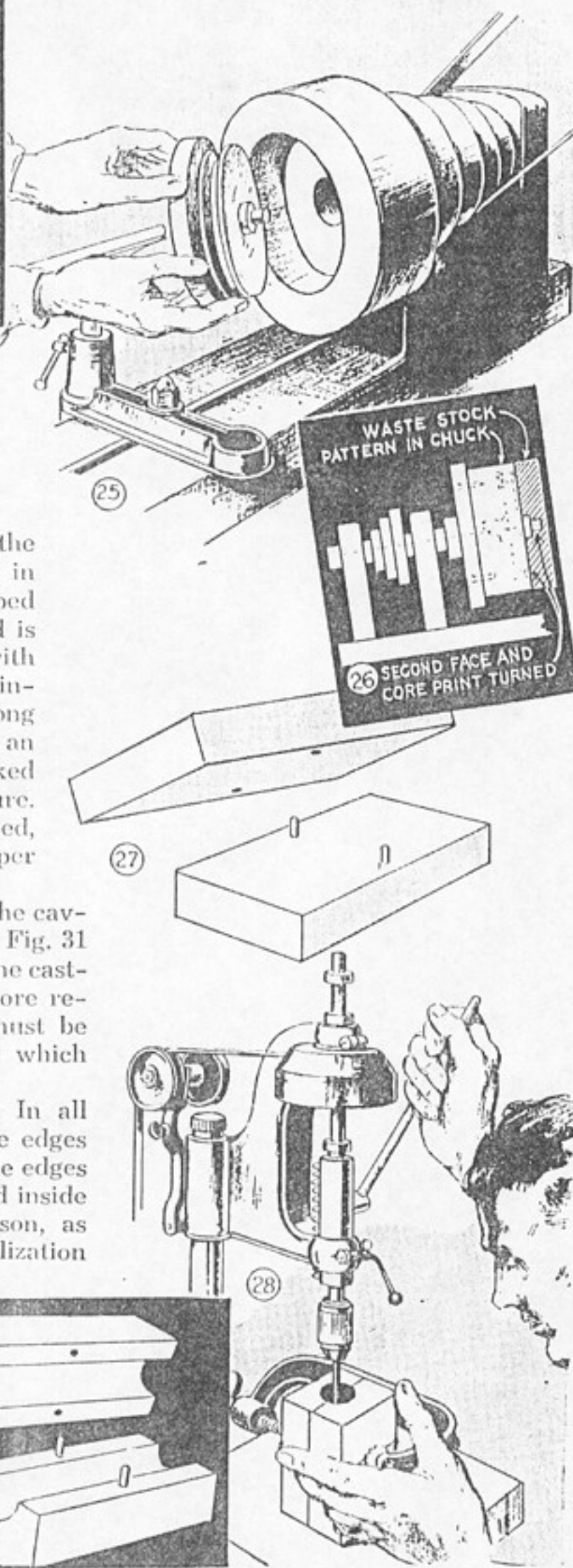


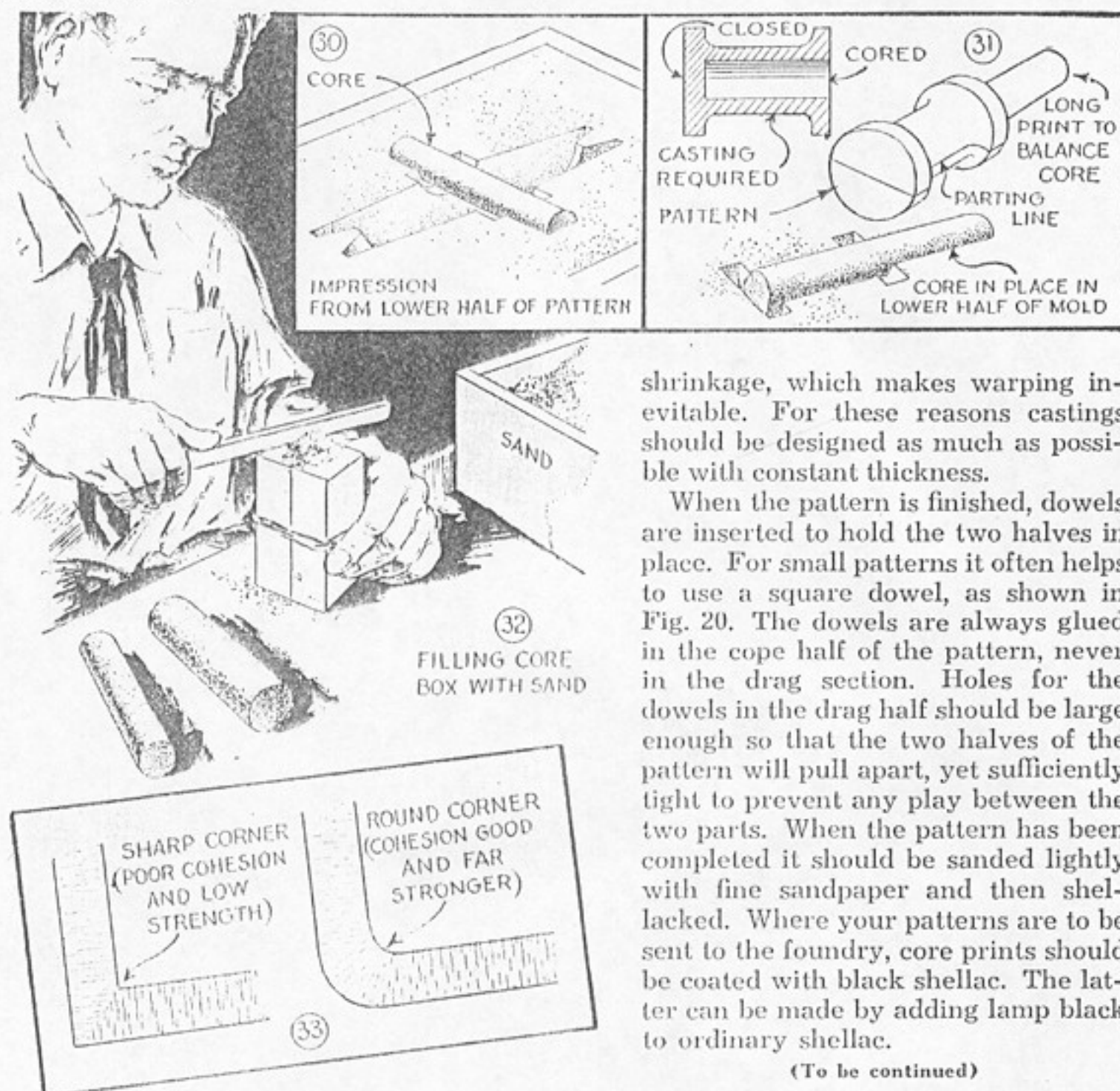
required, involving the use of carving chisels.

The core is made from common molding sand to which a small amount of some binding material such as linseed oil, molasses, or flour is added. The sand is dampened and the mold rammed full, and struck off as in Fig. 32. After this, the core box is rapped lightly to loosen the rammed core, and is then opened. Sometimes, especially with a long and slender core, iron wires are inserted in the core box to reinforce it along the length. The core is then placed in an oven at about 400 degrees F. and baked slowly to remove all excess moisture. When the mold for the casting is finished, the baked core is inserted in the proper position before closing the flask.

In some cases a core must overhang the cavity formed in the sand by the pattern. Fig. 31 illustrates an example of this, showing the casting to be made, the pattern, and the core required. In this case the core print must be longer than that portion of the core which overhangs the mold.

Now something more about fillets. In all castings it is necessary to avoid square edges and corners as much as possible. Outside edges of the casting should be rounded off and inside corners should be filled in. The reason, as shown in Fig. 33, lies in the crystallization characteristics of the metal. Crystals form perpendicular to the surface. The result is that the crystals fail to cohere at sharp corners. Shrinkage at the corner is in two directions, and the crystals are likely to pull apart and leave a crack or cavity, called a shrink hole. If the corners are rounded





shrinkage, which makes warping inevitable. For these reasons castings should be designed as much as possible with constant thickness.

When the pattern is finished, dowels are inserted to hold the two halves in place. For small patterns it often helps to use a square dowel, as shown in Fig. 20. The dowels are always glued in the cope half of the pattern, never in the drag section. Holes for the dowels in the drag half should be large enough so that the two halves of the pattern will pull apart, yet sufficiently tight to prevent any play between the two parts. When the pattern has been completed it should be sanded lightly with fine sandpaper and then shellacked. Where your patterns are to be sent to the foundry, core prints should be coated with black shellac. The latter can be made by adding lamp black to ordinary shellac.

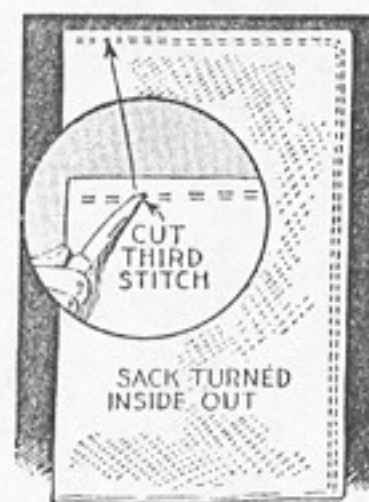
(To be continued)

there is a gradual change in the direction of the crystal axis, and the strain is far less, resulting in a stronger casting. This is a matter which should be considered in designing an article for casting. In making the pattern, the outside corners are simply rounded off. Inside corners can be made sharp if more convenient, and then filled back with fillets.

Another point to remember in designing articles to be cast is to have as few changes in thickness as possible. Whenever a change in thickness is necessary the change should be made as gradual as possible. Thick and thin sections of the casting will not cool at the same rate and consequently distortion is likely. Moreover, where the difference in thickness is considerable, there actually will be a difference in the

How to Unravel Stitches Quickly When Opening Cloth Sack

When you wish to open a sack of any kind so that the full width of the cloth may be used for some other purpose, simply turn the sack inside out, and with the double stitch to your right, cut the third stitch on either side of the sack with a sharp knife. Then by pulling the ends of the severed string, the sack may be opened.



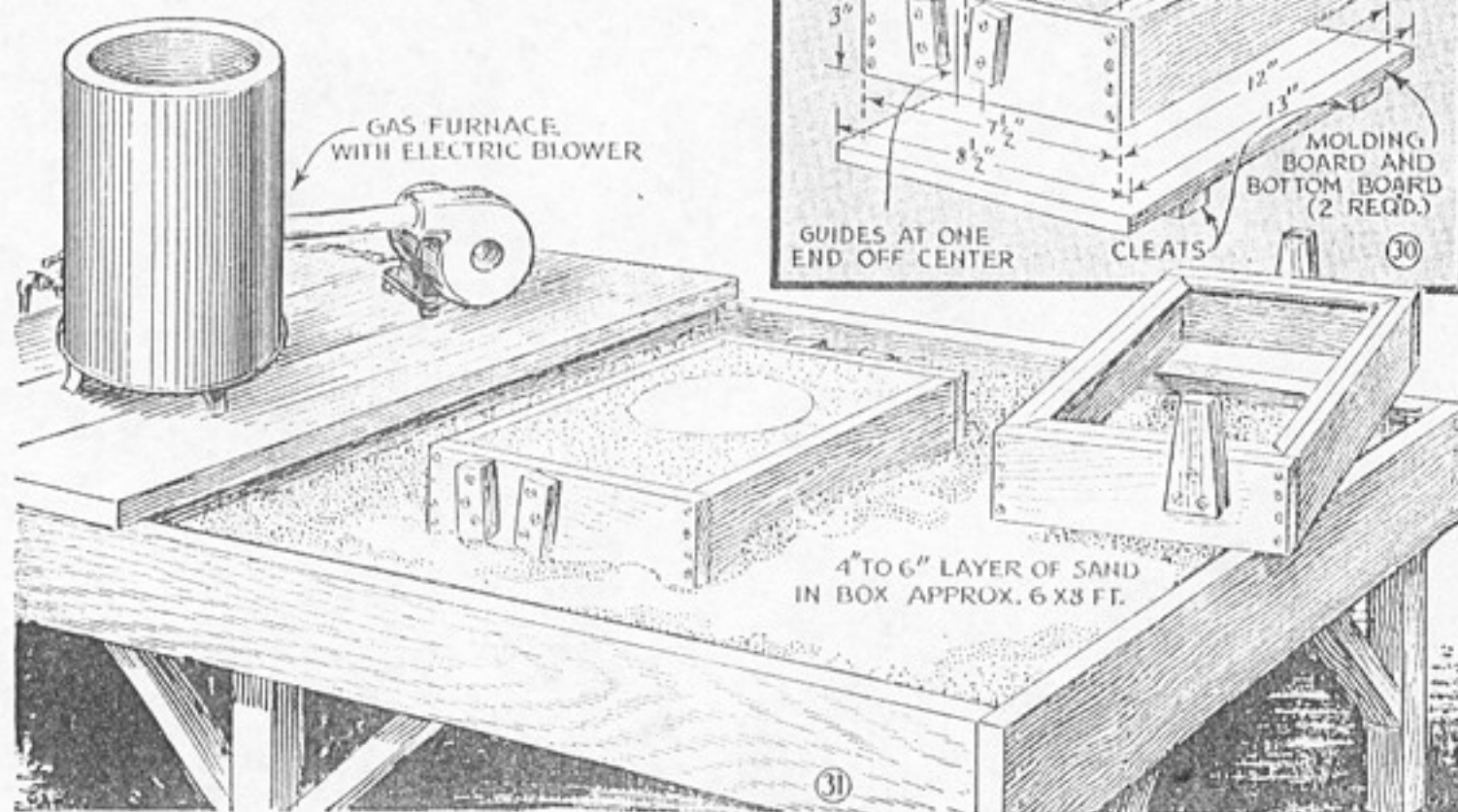
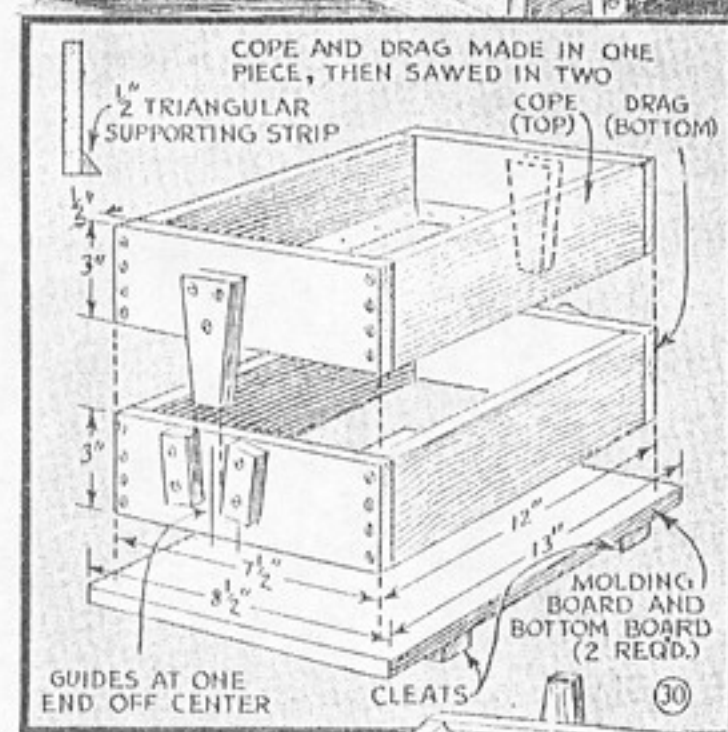
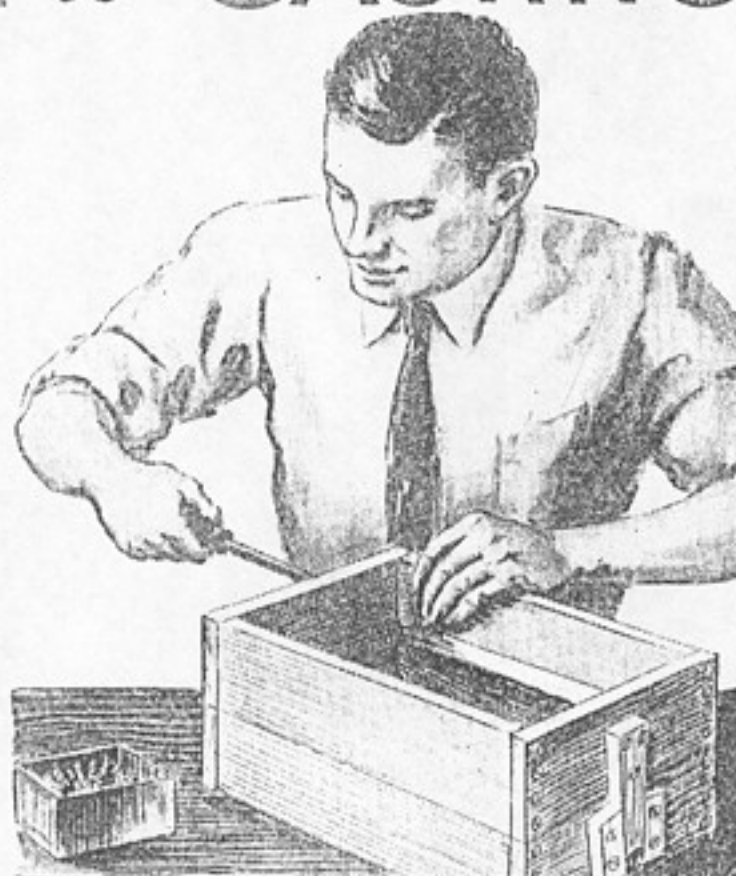
from **PATTERN to CASTING**

PART III

Foundry Methods—Sand Molding

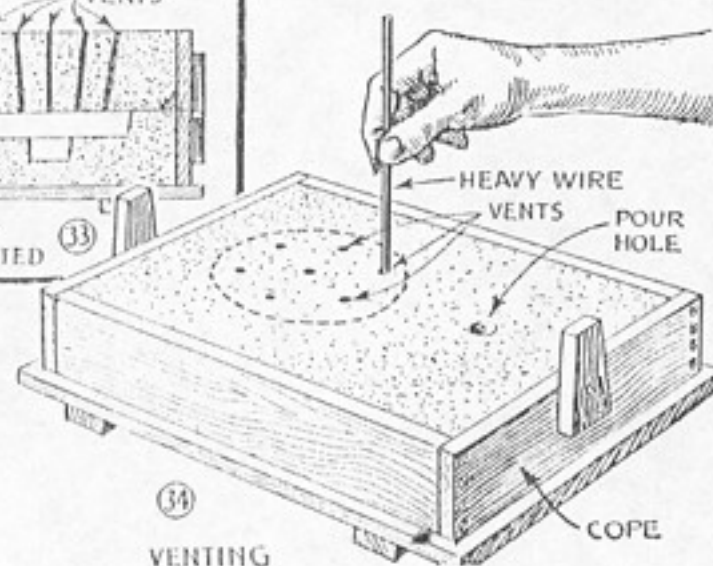
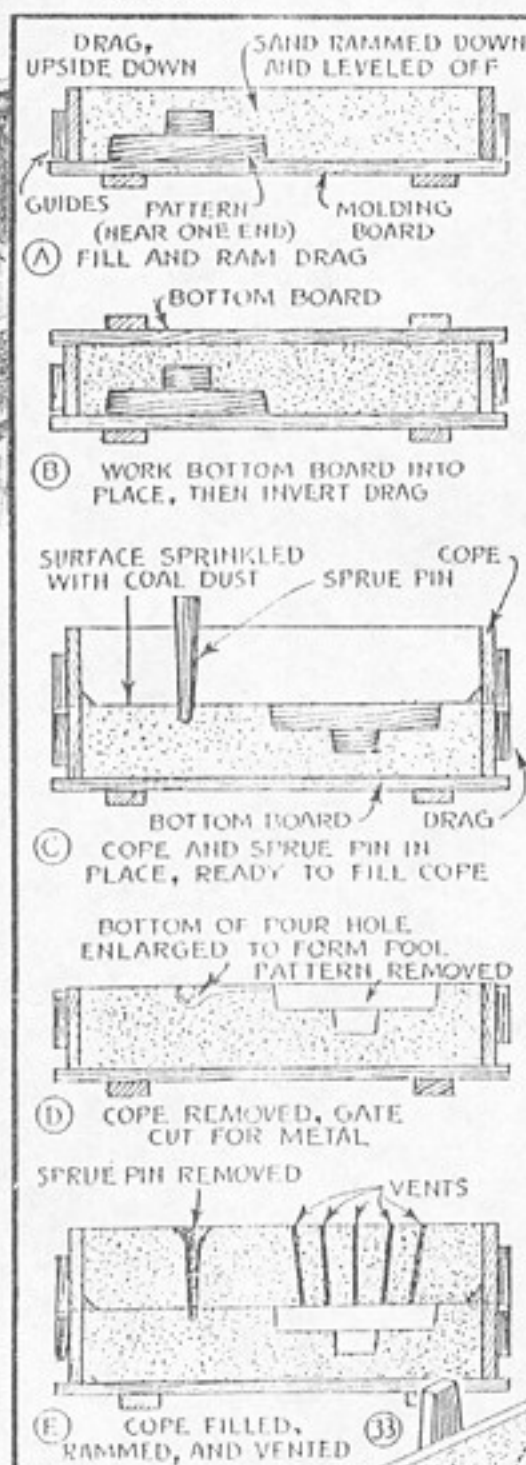
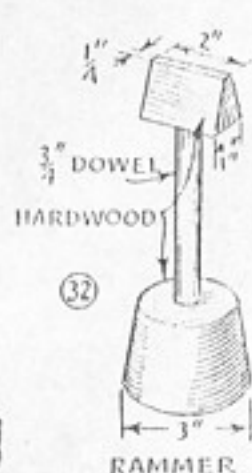
MAKING castings successfully involves the use of a carefully made pattern for the construction of a sand mold, melting of the metal, and finally the pouring of the mold. Once the pattern has been completed, it is not a difficult task to prepare the mold and cast the metal. By following through with details carefully, anyone can make small castings readily out of such metals as aluminum, brass, pewter and other low-melting alloys. Although essentially the same methods apply, the higher temperatures involved render casting from iron and steel impractical for the small home shop.

Castings are ordinarily made in a sand mold. The mold is prepared from the pattern in a box, generally of wood, which is called the flask. The latter is constructed according to the general plan outlined in Fig. 30, which gives dimensions suitable for small castings. Large flasks or smaller ones also can be prepared according to the same general plan. The two parts of the flask, called the cope and drag, are con-





structed as one piece, then the wedges and cleats which make it possible to align the cope and drag are fastened in place with flat-head wood screws. The guides at one end should be off center so that it will be easy to realign the parts. The long wedge is then removed, the flask is sawed in half to form the cope and drag, and the wedges are replaced. A triangular strip is nailed on the inside of the cope to help retain the sand. When two flat boards (molding board and bottom board) of the size shown in Fig. 30 are prepared, the flask is complete. Fig. 31 gives you a suggestion for a handy molding bench, entirely practical for the home foundry or the small shop. It's just a roughly built affair of $1\frac{1}{8}$ -in. boards, the latter for the bottom and sides and 4 by 4-in. stock for the legs. Height to the top of the bench sides should be about 28 in.,



a trifle lower than standard table height. This is an aid in handling the heavy sand-filled flask and the ladles or crucibles of molten metal.

Preparation of the mold is begun by placing the drag upside down on the molding board, A, Fig. 33, and placing the pattern in position, with parting surface down and near one end of the flask, as shown. If the draft of the pattern runs both ways from the parting line, the pattern will have

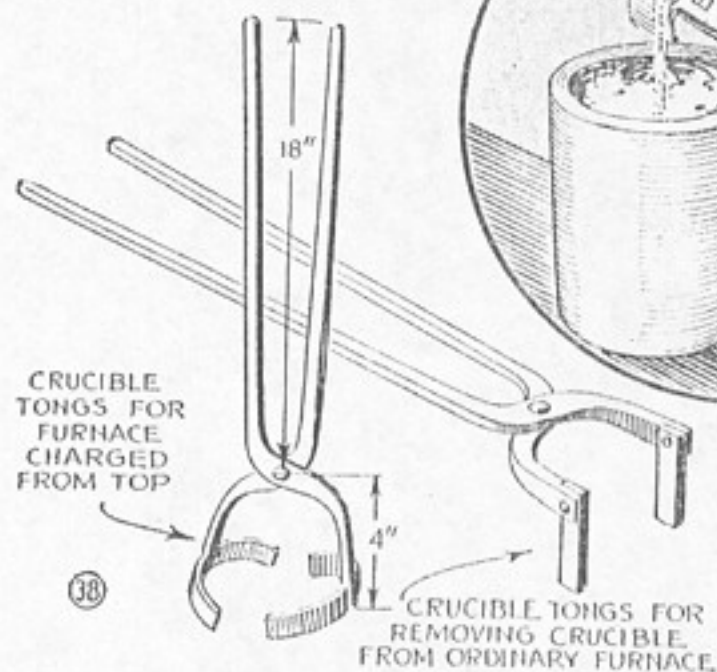
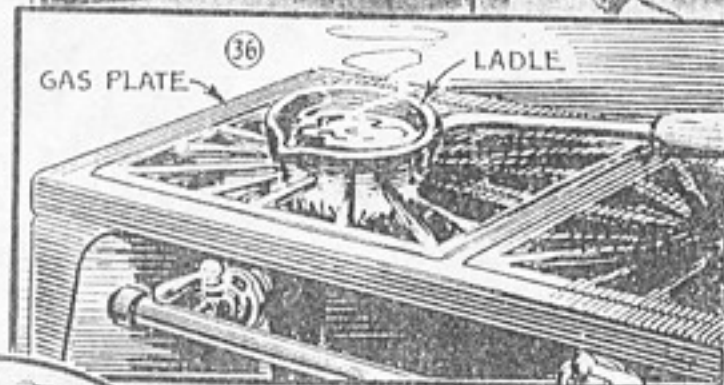
been made in two pieces and either of these may be put in position at this time. The sand must be "tempered" or dampened to the proper consistency. The sand should not be ordinary beach sand, which is generally too coarse, but regular foundry sand such as can be obtained from a foundry or a foundry supply house. It can be moistened with a small sprinkling can. To test its moistness, take up a handful and squeeze it into a lump. If it retains its shape and shows all finger marks it is right. If it crumbles it is too dry, and if it leaves moisture on the hands it is too wet. Sand that is too dry will crumble in the mold, while if the sand is too wet steam will be formed, causing blowholes in the casting and sometimes

dangerous blowing out of the molten metal.

The sand is spread over the pattern and rammed down firmly with a rammer, such as is shown in Fig. 32. The wedge-shaped end is convenient for ramming close to the edges of the flask. When the drag is filled and rammed, level off the top with a straightedge, sprinkle a little dry sand over the top, and place the bottom board on top, as at B in Fig. 33. Rub the board around until it rests firm without rocking, then grasp the drag and the two boards firmly between your hands, and turn the drag over. Slip the molding board off and sprinkle fine coal dust or parting sand from a cloth bag over the surface to aid in parting. Excess coal dust or parting sand should be blown off. For this operation a hand-operated bellows is very useful.

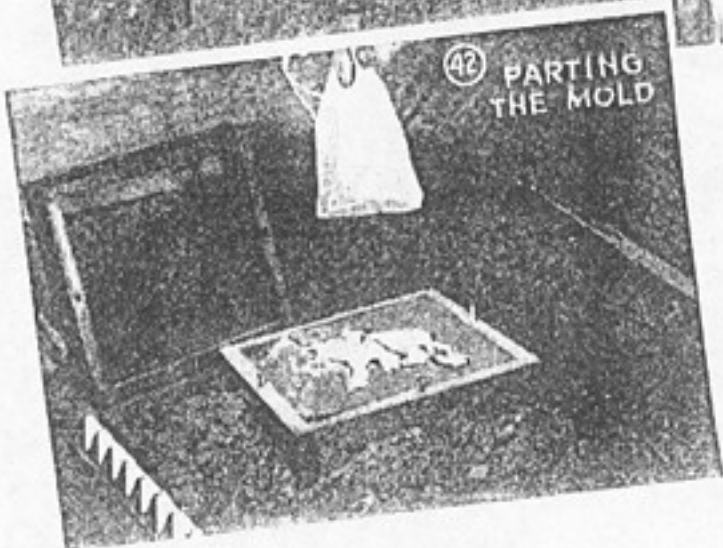
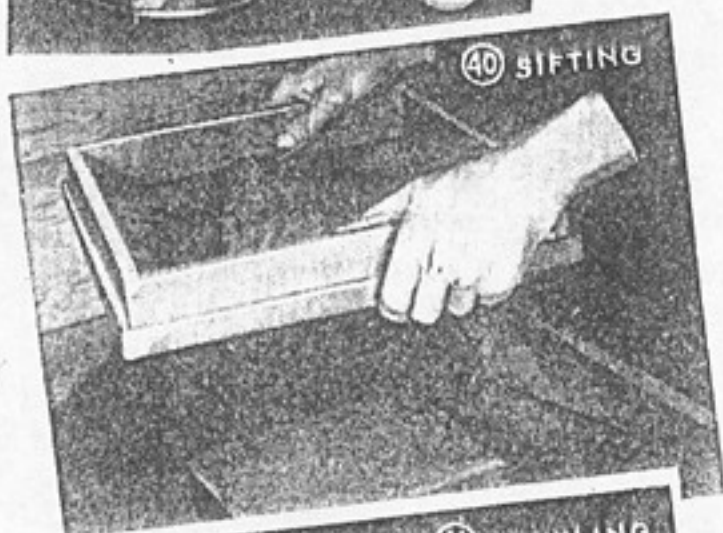
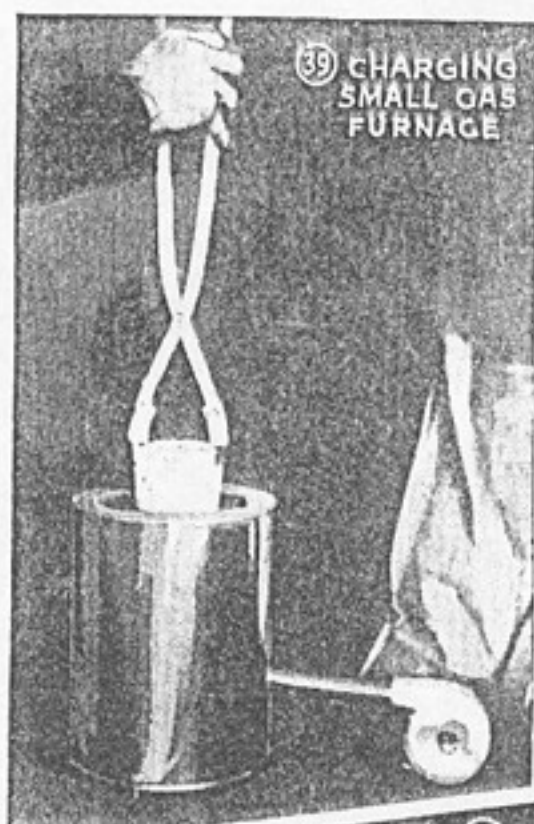
The cope is now put in place and a tapered pin set into the sand a few inches from the pattern as shown at C in Fig. 33. This is called the sprue pin and forms the sprue or pour hole. If preferred, the sprue pin can be omitted and the pour hole cut with a sharpened length of $\frac{1}{2}$ -in. pipe, or preferably tubing, after the cope is filled. If the pattern is in two pieces, the upper half is put in place at this time. When these preparations are finished the cope is filled with sand and rammed down in the same manner as the drag was. The top should be struck off carefully with a straightedge.

A straight length of heavy iron wire is used to punch the vents, E, Fig. 33, in the manner shown in Fig. 34. These are to permit the



escape of gases evolved when the hot metal is poured, and should be about an inch apart over the entire face of the pattern. After the vents are finished, the sprue pin is removed and the mouth of the pour hole enlarged to funnel shape, so that the mold appears as in D, Fig. 33.

The cope is now temporarily removed and set aside, care being taken not to damage the mold. It is best to place the molding board on top of the flask, then lift the cope and set it bottom side up on the molding board. A gate or path for the metal is cut in the surface of the drag, from the bottom of the pour



hole to the pattern. A small pool can be dug at the bottom of the pour hole. A spoon or trowel should be used to cut the gate, and all loose sand must be removed or tamped down carefully. A draw spike is driven into the pattern, the pattern is carefully rapped all around, and then is lifted from the mold. Any loose sand may be removed, and all breaks in the mold must be repaired. If the pattern is in two parts, the cope should be laid upside down on the molding board while the upper pattern is removed. The mold is now completed and it is only necessary to place the cope back in place on the drag.

A number of metals will be found suitable for casting, among them brass, aluminum, lead, tin, zinc, Britannia metal, pewter, and the like. Where alloys are used it will be just as satisfactory and cheap to buy them already alloyed, rather than attempt to prepare the alloy yourself. The metal should be melted in a

crucible, either of clay or graphite or of iron. A cheap substitute for a crucible can be made from a pipe nipple and a malleable iron pipe cap. The cap must be of malleable iron to stand heating. For small quantities of soft metal an iron ladle with a long handle will be found convenient. The melting preferably should be carried out in a special gas furnace, such as the one shown in Figs. 31 and 39. This one is gas fired and is fitted with an electric blower. The softer metal also can be melted in the basement furnace, as shown in Fig. 35. The crucible should be covered, and the live coals banked around it. Low melting-point metals such as lead and pewter can be melted on an ordinary gas plate or stove, Fig. 36. In all cases a small amount of borax should be added to combine with the dross that is formed. This is called fluxing, Fig. 37. Crucibles should be handled with a pair of crucible tongs. Blacksmith's tongs to which iron jaws have been riveted as shown in Fig. 38 will be found most convenient for handling the crucible and pouring the hot metal.

Because of the high temperatures involved, it is most important to be sure that no molten metal strikes wood, paper, or anything else inflammable. In all cases, a clear gangway should be left open between the molding bench and the furnace. It is also wise to work over a bed of dry sand, especially if the shop floor is of wood. It is necessary to make sure before you lift the hot crucible from the furnace that you have a firm hold on it with the tongs. Special precautions always must be taken to

offset any chance that the crucible might slip from the tongs and spill metal on the floor or on your hands or clothing.

The two halves of the flask must be held together as there will be a tendency for the cope to float when the metal is poured. One method is to lay a heavy slab of stone or metal on top of the mold.

When the mold is prepared and the metal is molten, it should be poured against the side of the sprue hole so that it flows gently into the mold. The crucible should not be held so high that the liquid will fall with excessive force. When the mold is filled it should be set aside until the metal has solidified. The excess metal in the crucible should be poured into a cavity in the sand, and allowed to cool. The "pig" thus formed can be remelted when needed. The metal never should be allowed to freeze in the crucible. Finished castings can be ground and polished as required. The molding sand can be used again but about 20 to 25 per cent of new sand should be mixed in at frequent intervals. Figs. 39 to 46 inclusive picture a variation of methods already described. Here any number of castings can be made from the same pattern, but it is necessary to ram up the mold for each separate casting. Frequently this is easier to do than making up a parted pattern, especially if the pattern is of irregular shape or is composed almost wholly of rounded or curved surfaces. In this method the drag is rammed right side up before the pattern is placed in position. The sand should be a trifle less moist than that used in the conventional procedure. After the drag has been rammed and struck off, the one-piece pattern is bedded one-half its thickness in the sand and the latter is leveled and parted as shown in Figs. 41 and 42. Then the cope is placed in position and rammed to complete the upper half of the mold. The remaining steps will be self-evident from examination of the illustrations. The cone of sand built up around the sprue pin as shown in Fig. 43 is sometimes a help when you are casting from a small pattern which has a projection extending well up into the cope. Frequently, in making small castings, the mold is not gated in the manner described, but instead the sprue pin is inclined slightly to form a slanting hole down which the molten metal runs directly into the mold.

